CQ

December 1974
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Oscar 7 in orbit

Nov. 15, 1974

details on p.5

08240 The Radio Amateur's Journal

most advanced design in amateur radio

The Heathkit "104" Systems

Heathkit SB-104

Unquestionably the most sophisticated SSB transceiver

totally new and revolutionary transceiver. If you've een looking for a transceiver with "no compromise" eatures and performance, here it is.

ompletely solid-state from the front-end to the RF out-ut, it uses over 275 solid-state devices including 31 C's, 75 transistors and 171 diodes. The four finals are otally protected from high SWR and thermal runaway roperly used, they should never need replacement. he SB-104 output board and final transistors are war-nted for one full year.

he 104 is totally broadbanded.

witch from 3 to 30 MHz in seconds without preselec-r, load or tune controls.

rue digital readout—six bright digits read out the fre-uency with resolution down to 100 Hz on all bands. he readout takes all three sources into account—VFO, FO and BFO, so you get absolutely accurate display operating frequency.

nprecedented performance.

he transmitter delivers a solid 100-watt output and, r QRPers, a front-panel button instantly changes the utput to one watt. Harmonic and spurious radiation e low, third-order distortion is down 30 dB or better full power. Carrier and unwanted sideband suppres-on are down 55 dB. The receiver section is equally mpressive. Cross-modulation and intermodulation have een minimized and there are very few active devices ead of the highly selective crystal filter. Adjacent gnal overload is non-existent, yet sensitivity is better an 1 μV.

nd what features!

ont panel controls include a large VFO spinner with out 30 kHz per revolution, drive level, AGC (fast, ow, off), pushbuttons for USB/LSB/CW, a tune button r loading linear amps, power on/off, pushbutton me-ring of DC input voltage, ALC action and relative wer. The built-in VOX is controlled by front-panel out, gain and delay controls. For instant time up-tes, there's a 15 MHz WWV receive position on the ndswitch. We've even left space on the readout panel install your own call sign and included all the letters d numbers you need.

e SB-104 operates from 12-volt power, so it's ready go mobile when you are. The optional HP-1144 power pply lets you use the SB-104 in a fixed station. Back nel inputs and outputs include: phone patch, separate and Rcv antennas, IF out, driver out, VFO in and out.

optional 400 Hz crystal filter plugs into one of the cuit boards to improve CW selectivity. An optional gital noise blanker can be installed in the SB-104 to duce ignition noise. It is controlled by a front-panel out switch and provides up to 50 dB of effective anking with a repetition rate of 10 to 2000 pulses per cond and pulse widths of 1 to 250 microseconds.

sy assembly and alignment.

en though the SB-104 is a complex piece of equip-nt, we've kept construction simple by modularizing. All but a handful of the parts mount on 15 glass epoxy circuit boards, and two harnesses eliminate 95% of the wiring. Eleven of the boards plug in for easy assembly and servicing—seven can be extended from the chassis while the transceiver is operating. Because of the broadband design, alignment is fast and requires only a dummy load, mike and VTVM.

It's years ahead in design and features.

Just about the only thing that isn't new about the SB-104 is the quality that's made Heath one of the most respected names in the industry.

Kit SB-104, 31 lbs., mailable **669.95***

Kit SBA-104-3, 400 Hz CW crystal filter, 1 lb., mailable **34.95***

Kit SBA-104-1, noise blanker, 1 lb., mailable ...**24.95***

Kit SBA-104-2, mobile mount, 6 lbs., mailable ..**34.95***

Heathkit SB-230

The lowest cost conduction-cooled linear anywhere

The best linear value ever!

The super-performance silent partner of the SB-104, it puts out 1200 watts PEP and 1000 watts CW from less than 100 watts input. It's also rated at 400 watts input for slow-scan TV and RTTY. Third order distortion is low—30 dB down. The high-efficiency Eimac 8873 triode is completely enclosed in a double-shielded compartment to reduce stray RF. Super quiet, too, since the massive heat sink eliminates the need for noisy fans or blower.

Complete operating convenience.

All the controls are at your fingertips—single-knob bandswitch, load and tune controls, relative power sensitivity plus metering for relative power, plate current, grid current and plate high voltage.

A full complement of safety features.

The cabinet features microswitch interlocks to cut off the power whenever the top or bottom shells are removed. When thermal shutdown occurs, the Hi-temp light glows. The Exciter light signals that the linear is running straight through without amplification. The Delay light stays on until the output tube is warmed up. The on/off switch includes a circuit breaker for the primary side of the power transformer and the cathode of the tube is fused for additional protection.

Kit to transmit in 15 to 20 hours.

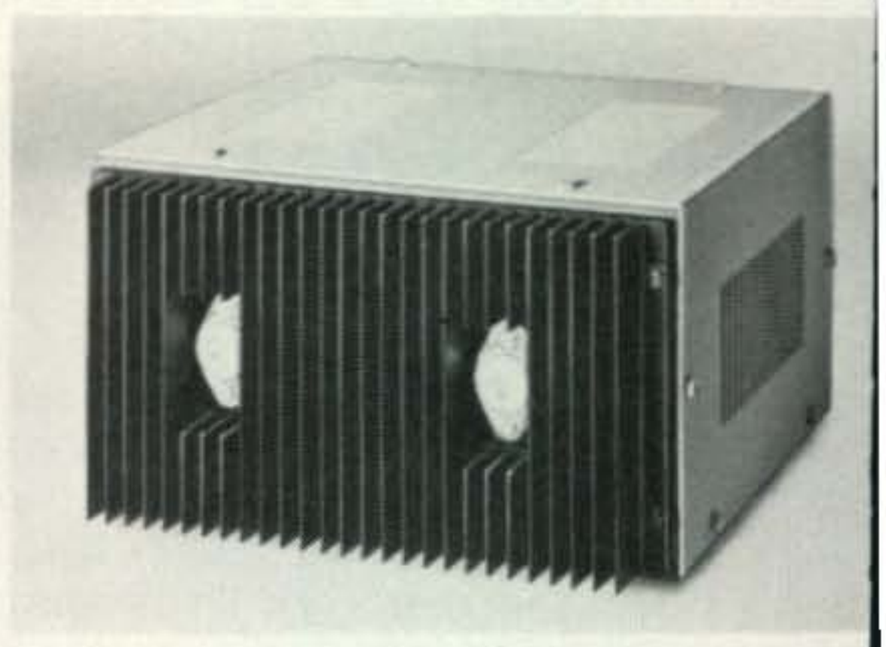
Most components are chassis-mounted and point to point wiring is held to a minimum. After a few preliminary checks with an ohmmeter, you're on the air—no alignment necessary.

The new SB-230 is styled to match the SB-104 transceiver. Check the performance and the price, we think you'll agree that, dollar for dollar, the SB-230 is a super value.

Kit SB-230, 40 lbs., mailable **319.95***

complete your SB-104 rig with Heathkit accessories

A) HP-1144 Fixed-Station AC Power Supply



This new 120 V/240 VAC supply provides the 13.8 VDC required by the SB-104. The full-wave bridge circuit has triple Darlington regulation with an integrated circuit which samples, compares, and automatically adjusts transistor bias to maintain a fixed output level. Output is remotely sampled at the load end of the power cable to compensate for voltage drop across fuse and cable. There's almost no change in voltage from no load to full load. A cable and socket provide output power and a series connection to the SB-104 on-off switch. The generous heat sink fits on the back of the supply and the entire unit may be mounted inside the SB-604 speaker cabinet.

Kit HP-1144, 28 lbs., mailable **89.95***

B) SB-604 Station Speaker

Designed and styled to match the new SB-104 Transceiver, the cabinet is large enough to house the HP-1144 AC Power Supply. The 5 x 7″, 3.2 ohm speaker is response-tailored for SSB. Connector cable and plug are included.

Kit SB-604, 8 lbs., mailable **29.95***

C) New SB-614 Station Monitor

How clean is your signal? With the SB-614, you'll know. It monitors transmitted SSB, CW, and AM signals up to 1 kW from 80—6 meters. The highly visible 1½ x 2″ CRT has push-pull drive for a keystone-free, sharp, clean trace. It reveals a wide variety of common operating problems: non-linearity, insufficient or excessive drive, poor carrier or sideband suppression, regeneration, parasitics and CW key clicks.

Complete controls—Vertical Gain & Position, Horizontal Gain & Position, Focus, Mode (SSB, Trapezoid & Cross for RRTY Mark/Space adjustments). The improved recurrent, automatic sync sweep generator has three ranges from 10 Hz to 10 kHz. Front panel control gives 11 steps of attenuation. The "614" can be used as a normal scope, within its 10 Hz to 50 kHz bandwidth. A rear panel 10:1 vertical attenuator provides extra convenience.

Additional features include all solid-state design; rear panel Astigmatism control; horizontal and vertical inputs for use as a scope; exciter and linear inputs/outputs.

Kit SB-614, 17 lbs., mailable **139.95***

D) New SB-634 Station Console

Five station accessories in one! The new "634" provides five necessary functions that every amateur can use.

24-hour digital clock: six half-inch digits indicate hours, minutes and seconds. And the clock runs independently of all other functions.

Ten-minute ID timer: Three gas discharge digits indicate minutes and seconds up to 9:59. At ten minutes the timer recycles and provides either a visual alarm or both visual and audible alarms. Pushbutton zero reset.

RF wattmeter: The big meter has two ranges—200 watts or 2000 watts full scale ±10% accuracy from 160 through 10 meters.

SWR bridge: Push a button to measure SWR. Separate front panel SWR sensitivity control.

Phone patch: The hybrid patch can be used manually or with VOX control without switching connections. Push a button to select VU capability on the meter and use the separate front panel controls to adjust transmitter and receiver gain independently. Line isolation is at least 30 dB, and can be adjusted with a rear panel control.

Kit SB-634, 14 lbs., mailable **179.95***

E) New SB-644 Remote VFO

Designed exclusively for the new SB-104. Provides split transmit/receive without a separate transmitter and receiver. You aren't frequency limited in any way—the transceiver can be at one end of the band, the remote VFO at the other end.

Multi-mode capability. The "644" allows transceive operation on either itself or the "104"...transmit on the "104" and receive on the "644"...receive on the "104" and transmit on the "644". And you can use either of the two crystal positions in the "644" for fixed-frequency control.

Easy pushbutton operation. Front panel pushbuttons control all transceive, transmit and receive modes on both the "104" and the remote VFO. Status lamps behind the window indicate frequency-control mode.

Digital readout in the SB-104. Although the SB-644 includes a linear dial on its front panel, actual frequency readout takes place in the "104". The digital display automatically changes to the correct frequency as you go from transmit to receive.

Kit-built VFO. The "644" uses the same kit VFO as the new SB-104. The VFO goes together easily, quickly, and with a minimum of adjustments. And the "104" requires no modifications...just plug in the remote VFO and go. If you work serious DX with your new SB-104, you'll want the new "644" to make the job easier. Order it now.

Kit SB-644, 10 lbs., mailable **119.95***

an important message from Heath amateur radio product line manager, Joe Shafer

DESIGN NOTES

Joe Shafer K8DCE
Communications
Product Line Manager

Dear Fellow Radio Amateurs:

The development and introduction of the SB-104 SSB Transceiver has been a challenging and exciting experience for us at Heath.

Our engineers worked to a tough set of design goals and developed a truly remarkable SSB transceiver that features digital frequency readout, no receiver or final amplifier tuning, 100 watts output and superior receiver cross modulation performance—all on easy to build plug-in epoxy glass circuit boards.

Our advertising has done a reasonable job of explaining these features to you; however, I know that some of the circuits and components used in the SB-104 are probably new or unfamiliar to you. Therefore, I feel a deeper look into some of these new circuit techniques may be helpful.

To discuss these new techniques, I have asked our design engineers to prepare a series of brief technical papers on the more interesting areas of the circuitry used in the SB-104. These papers will appear in this column each month under the title "Design Notes".

Some of the topics to be covered in the initial issues of the series will be: "How receiver performance is improved without an RF stage", "Techniques and circuitry in broadband solid state amplifier design", "Circuitry and components in digital frequency readout".

Not only will future "Design Notes" be a source of technical information, but they will allow you to meet some of our Design Engineers who were directly involved with the design of the SB-104...a design, I believe, that presents the greatest step forward in amateur radio SSB equipment in over a decade.

I hope that our "Design Notes" column will receive high priority as you read your favorite publication each month.

73,

Joe

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The Radio Amateur's Journal

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ZERO BIAS

OSCAR 7 Launched Successfully and Working A-OK!

Mark November 15 as another landmark in the history of amateur radio! At exactly 1711 GMT a two stage Delta vehicle lifted slowly off its pad at NASA's western test range near Lompoc, California. Shrouded in a wall of orange-yellow flame and with a tremendous roar, it streaked southward into a cloudless, deep blue sky.

The prime mission of the spacecraft was to launch the fourth operational NOAA weather satellite and INTASAT, a scientific satellite built by Spain. But of greater importance to radio amateurs was the third passenger aboard the giant Delta - AMSAT OSCAR 7, with its two radio amateur repeaters, three telemetry beacons and other communication innovations. It was a textbook launch and all went according to the preflight scenario.

OSCAR-7 was ejected from the parent vehicle at 1828:33 GMT high above Greece, and within seconds its 435.100 MHz telemetry beacon was operating and being received by radio amateurs throughout Europe.

DK2ZF near Hamburg acquired the beacon at 1828:46 GMT and reported the first complete frame of telemetry data. G3IOR, PAØAA, GB2SM, G2BVN, DL3SX, DL9GU and DJ8IM, among others, also reported hearing the satellite from its first beep.

Credit for the first US station to copy the beacon appears to go to K7BBO who acquired it at 1846:37 GMT followed 13 seconds later by K1HCV and just after that by WØPHD.

As planned, the 2-to-10 meter repeater was sucessfully placed into operation along with the 29.50 MHz telemetry beacon an hour after midnight GMT on Nov. 17. The 432 MHz-to-2-meter repeater went into operation as planned on Nov. 18 along with the 145.980 MHz telemetry beacon.

At press time, telemetry readings and the operation of both repeaters indicate that the newest radio amateur satellite is working according to plan. Hundreds of QSO's have been made through both repeaters during the first few days of operation including many trans-Atlantic contacts. The signals relayed through the 432 MHz-to-2-meter repeater have been much stronger than expected and no more than 80 watts ERP should be necessary rather than the 400 watts originally estimated.

OSCAR 7's initial orbit parameters are: Period - 114.99 min.; Longitude Increment-28.748 ; Inclination to Equator - 101.73 . Its orbit is almost exactly circular at 1445 km above the earth's surface. These are very similar to OSCAR 6's orbital parameters, but a half period or 57.5 minutes out of phase.

The 2-to-10 meter repeater will be available for world-wide communication on Sunday, Tuesday and Friday GMT days, and the 432 MHz-to-2-meter repeater on Monday, Thursday and Saturday GMT days. The repeaters are not available for communication on Wednesdays.

Complete details on the OSCAR 6 and OSCAR 7 satellites appeared in the October issue of *CQ* and there will be a more complete report and updated orbital data in next

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month's issue. Remember that OSCAR 7's 2m. uplink is between 145.85 and 145.95-MHz, and the 10 m. downlink is between 29.40 and 29.50 MHz with telemetry beacon at 29.50 MHz. The 432 MHz uplink is between 432.125 and432.175 and the downlink is inverted between 145.975 and 145. 925 MHz with beacons at 145.980 and 435. 100 MHz.

In the US the new satellite should be in view for communications up to 4000 miles for at least three successive orbits during the morning hours and three during the evening. It should remain in range for up to 20 minutes on nearly overhead passes.

All of amateur radio can bask in the glory of the OSCAR 7 success. It's another tangible contribution that amateurs have made in advancing the state of the communications art. It should weigh heavy in our defense of our bands when the h.f. spectrum is carved up again at the international frequency conference planned for 1979. For example, the 10 meter band, once almost barren above 29 MHz and looked upon greedily by other services, is now almost solid with amateur signals relayed by OSCAR 6 and OSCAR 7 between 29.40 and 29.55 MHz.

Special credit must go to the talent, sincerity and devotion of the many radio amateurs in the US, Canada, Germany and Australia who participated in the actual design, construction and testing of the satellite, to members of AMSAT, to the ARRL, and to the European members of IARU, all of whose funding and support made OSCAR 7 a reality.

To Jan King, W3GEY, Project Manager of AMSAT-OSCAR 7, our special congratulations and ourapology for not identifying him as the handsome gentleman on the October *CQ* cover.

We here at *CQ* take quiet pride in the seven OSCARs launched to date. It all started in our magazine with an idea put forth by Don Stoner, W6TNS, in 1959 and was followed up partly on the initiative of our Space Communications Editor, George Jacobs, W3ASK, with the formation of the Project OSCAR Association and the sucessful launching of OSCARs 1,2,3, and 4. George also sparked the interest through these pages that led to the establishment of AMSAT and the development of OSCARs 5,6, and 7.

We at *CQ* are eagerly looking forward to a bigger and better OSCAR 8 and you'll be reading about it here in *CQ* in the near future.

Message from the Publisher

Our message from the publisher that appeared on page 5 of the October *CQ* has prompted, as we anticipated, considerable reaction from subscribers. Most reaction was, as we had hoped it would be, comment that *CQ* was well respected, and that even an economized version of *CQ* is still a valuable asset to the operating amateur. We did receive a total of sixteen subscription cancellations (almost all of these indicated that the free classified ad withdrawal was the influencing factor. There will be a replacement program for that announced elsewhere in this issue) and a few phone calls from concientious advertisers offering additional ad support to get *CQ* rolling on a profitable basis.

It also prompted, as expected, an editorial comment in *73* from W2NSD in his inimitable fashion, stating that should *CQ* cease publication he'd be happy to take over our subscriber list, contests, etc. Over the years Mr. Green has hinted many times that *CQ* might disappear from the scene. He never misses an opportunity to get in a dig that might prove embarrassing to a competitor. Bravo, Wayne! You never fail to show your true colors when the chips are down. And as we've said before, the name may be Green but the journalism is inevitably quite yellow.

At any rate, we wish to assure our readers that our retrenchment measures have proven most successful; *CQ* will show a modest profit for the first time in many months with the October issue, and projected business is definitely on the upswing. You need not fear that *CQ* will cease publication. That is not and has never been our intent. We're grateful for the many kind comments from readers and advertisers alike, and we expect that *CQ* columns and contests will be an integral part of amateur radio for many years to come.

Richard A. Cowan, WA2LRO
Publisher, *CQ*

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The No. 10031 Dial is a rugged turns counter dial designed for direct crank-handle drive of multi-turn devices such as vacuum variable capacitors, rotary inductors, multi-turn potentiometers, permeability tuned inductors, etc. It has a 0-99 turn digital readout plus a 0-100 vernier scale. The output coupling is a hub for 1/4" diameter shafts. The design includes a built-in dial lock.

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Announcements

Sandusky, Ohio

The Erie Amateur Radio Society will hold its' Semi-Annual Swap and Auction on Sunday, December 1rst, 1974. Cash Grand Prizes; admission: $1.00. For more information call: Earl L. Carrier K8WLP. Call in on 52/52.

Passaic, New Jersey

The Knight Raiders VHF Club, K2DEL, will sponsor a VHF Activity Week to be held December 23, 1974 thru January 1, 1975. Contact may be made on any band above 50 Mhz. Participants who work the club station and 5 club members will receive a Knight Raiders Award certificate. Those who work at least 10 of the 16 municipalities in Passaic County will receive a Passaic County Award certificate. Stations within Passaic County are eligible for both awards. A one dollar fee must be sent for each certificate for the cost of handling and postage. Send fee and logs to: Knight Raiders VHF Club, P.O. Box 1054, Passaic, New Jersey 07055.

Fort Wayne Indiana

On January 19th 1975, The Allen County Amateur Radio Technical Society will sponsor The Fort Wayne Hamfest. It will take place at Shiloh Hall, ½ mile West of Ind. 3 on Carroll Rd. Tickets are $1.50 and children under 12 years of age are admitted free. For more information write: P.O. Box 342 Fort Wayne, Indiana 46801.

Wheaton, Illinois

The Wheaton Community Radio Amateurs will have their annual mid-winter hamfest on Sunday, February 9th at the DuPage County Fairgrounds in Wheaton, Illinois. For information and advance tickets send a SASE to L.O. Shaw, W9OKI, 433 S. Villa Ave., Villa Park, IL 60181.

Flushing, New York

The following Amateur Radio equipment was stolen from the Hall of Science Radio Club earlier this year: Eico no. 720 CW Transmitter, Eico no. 722 V.F.O., Heathkit HR-20 Receiver, Globe Scout CW Transmitter, Hallicrafters SX99 Receiver, MC-4 Mobile Console Wattmeter, Homebrew Transmatch and CD Ham M Station Console. Anyone who might aid in the recovery of this equipment, please write to: Hall of Science Radio Club, Flushing Meadows - Corona Park, P.O. Box 1032, Flushing New York, 11352.

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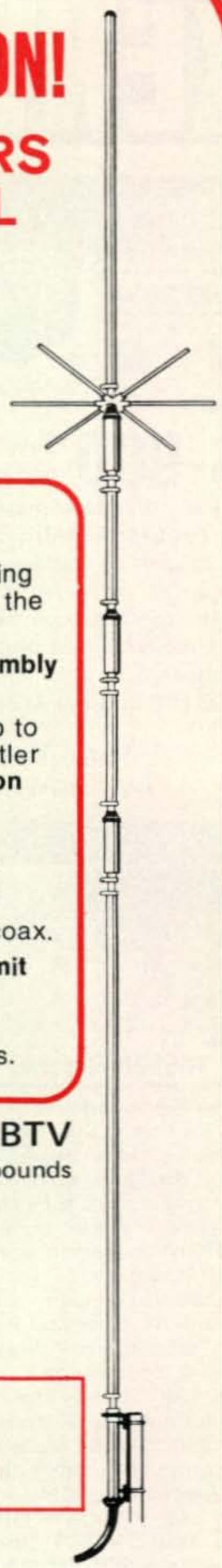

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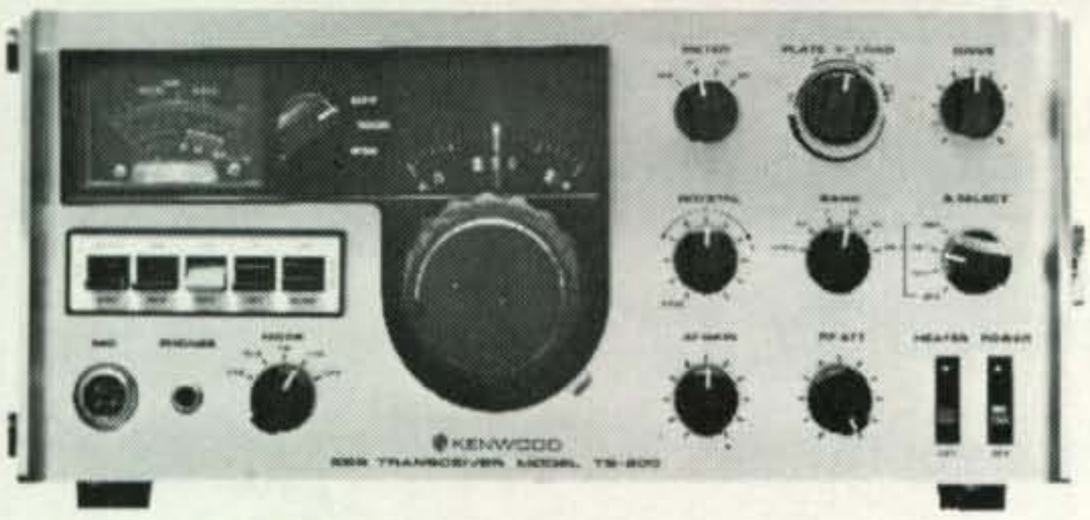

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223.26	224.74	146.19	146.72	52.82	52.68
223.30	224.86	146.22	146.76	52.88	52.72
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I would recommend the Triton to anyone interested in MODERN CW operation.

73,
Bill
Bill
WA7LRU/W6UF

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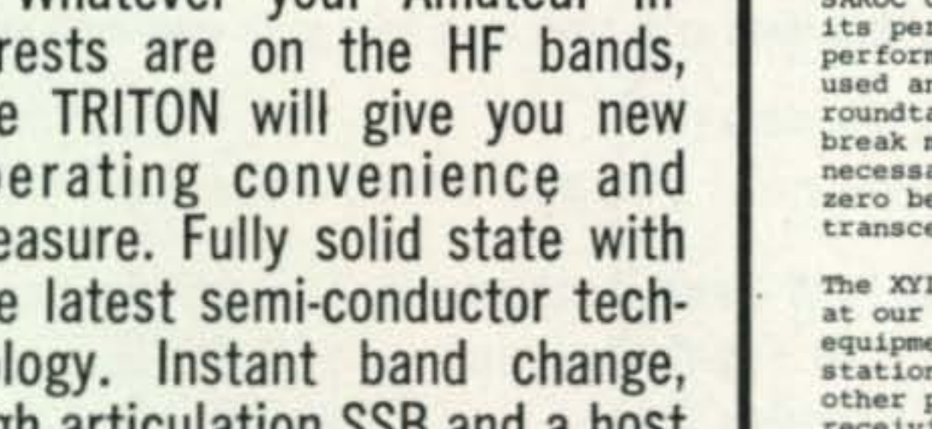

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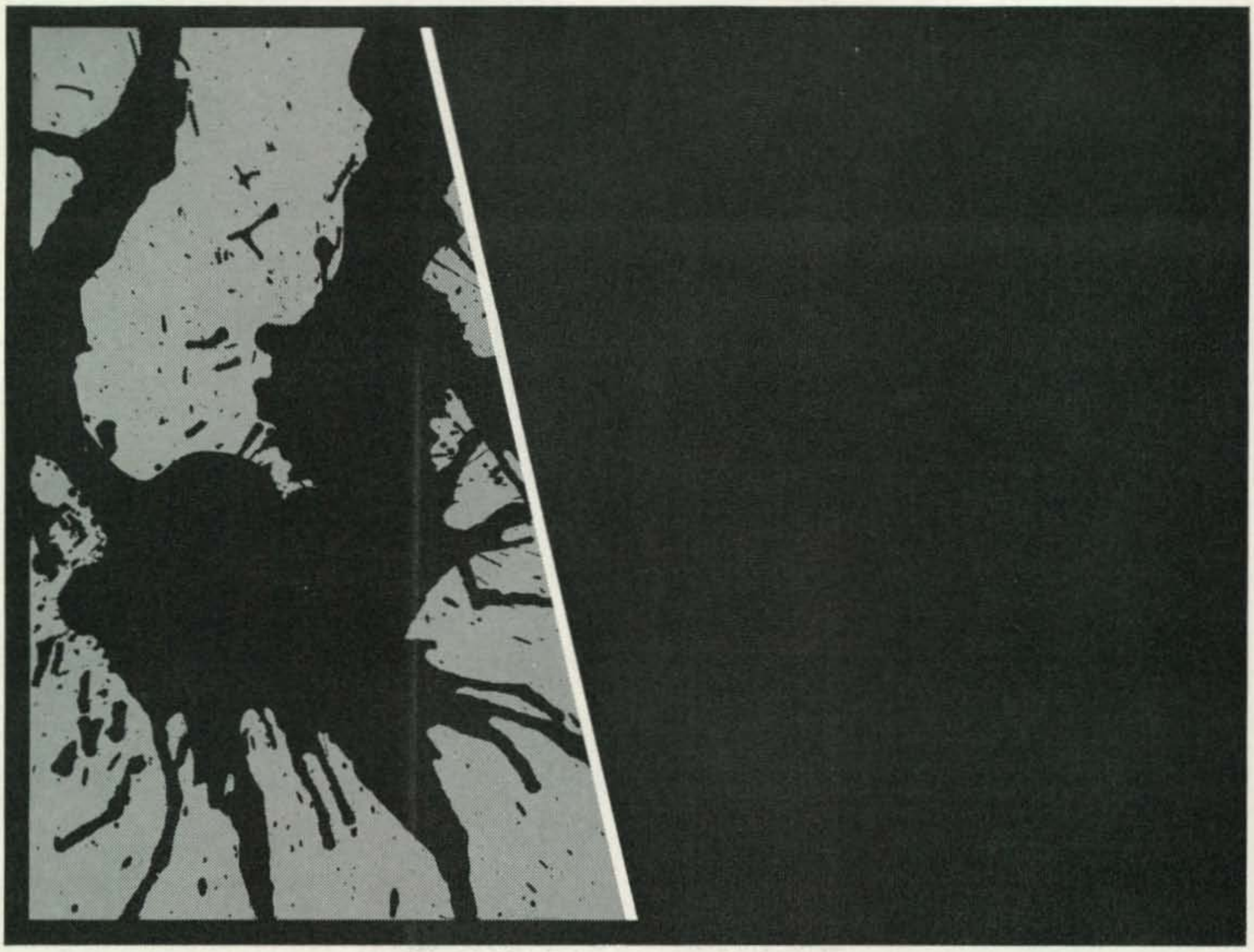

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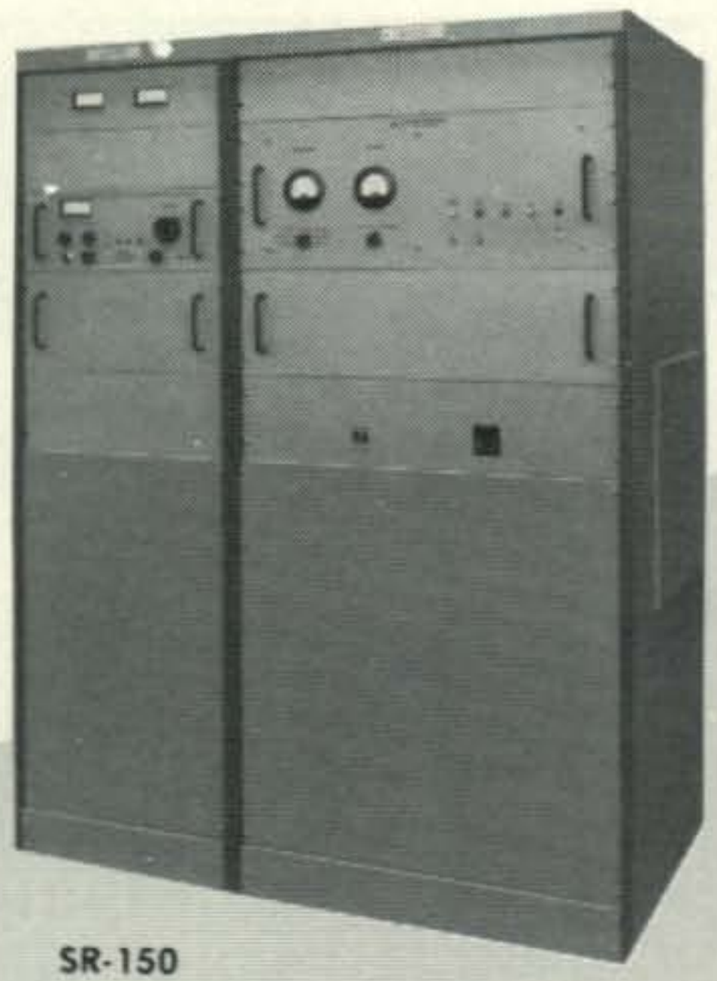

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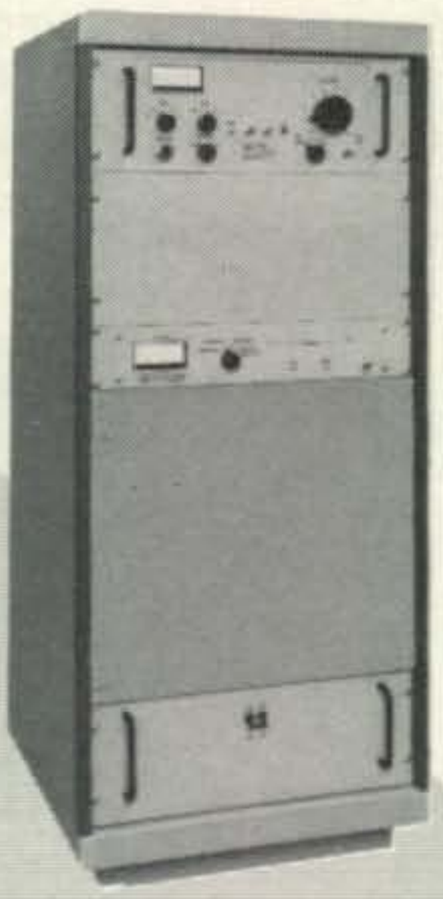

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THE URC-87 and the Atlas-180 are what you might call 'first cousins.' Atlas Radio is licensed by SouthCom International, and thus has access to the advanced state-of-the-art circuit designs by Les Earnshaw, President of SouthCom. Les is widely recognized as one of the foremost solid state radio engineers in the world, and the URC-87 is an outstanding example of his work.

The Atlas-180 uses the same basic circuitry as the URC-87. There are some differences of course, such as a tuneable VFO in place of the frequency synthesizer, and we can't guarantee underwater operation. But the outstanding receiver and transmitter performance is there, and accomplished with far fewer components than any comparable equipment. Together the URC-87 and the Atlas-180 enjoy a reputation for performance and reliability that make them truly superior transceivers, the envy of competitors.

There are now over 1000 Atlas-180's on the air all over the world. Their growing reputation for excellent quality, receiver sensitivity, selectivity, and transmitter punch, all ties back to the URC-87. Immunity to overload and cross modulation from strong adjacent channel stations is nothing short of fantastic. Selectivity is provided by a new 8 pole ladder designed super filter, with shape factor and ultimate rejection superior to practically any other receiver or transceiver! And the front end design permits full utilization of the filter's capabilities.

The one area where we have an edge over the URC-87 is in transmit power, and that's because the Atlas-180 doesn't have to operate on self contained batteries. The 100 watts of output speaks out with real authority!

Modular construction with plug in circuit boards permits easy servicing, when required. However, built to top commercial specs, this isn't very often. But when service is needed, Atlas Radio backs every set with a service policy second to none. Your satisfaction is guaranteed.

73
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Size: 15½" deep, 14" wide, 8¼" high. Weight 26 lbs.
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ALC Option. Automatic Light Control may be added if desired. This optional feature allows the operator to leave the iris of the lens at one F setting (all the way open if desired), as the camera will adjust itself to light changes automatically. The light can then be varied on the scene, thus eliminating adjustment of the lens opening or the camera Contrast control. Auto/Manual switch which allows the operator to return the camera to normal operation when ALC is not being used. Add $40.00 to basic HCV-1B price for this optional feature.
Fully meets or exceeds all currently accepted SSTV standards World-wide.
Built to rigid industrial specifications for long trouble-free service. Full 1 year warranty-90 days on Vidicon Tube. Printed Circuit Board exchange program and complete service department available if ever needed. A separate lab facility is also available which is involved in making improvements and testing our new designs prior to production. Modifications, improvements, etc., are sent out as they are made. 24 hour telephone answering service to better serve our customers. Size: 6" wide, 8" high, 13¼" long. Weight: 12 lbs. (with lens). Color: Black & White or Optional 2 tone Gray - No extra charge. Aluminum Cabinet.
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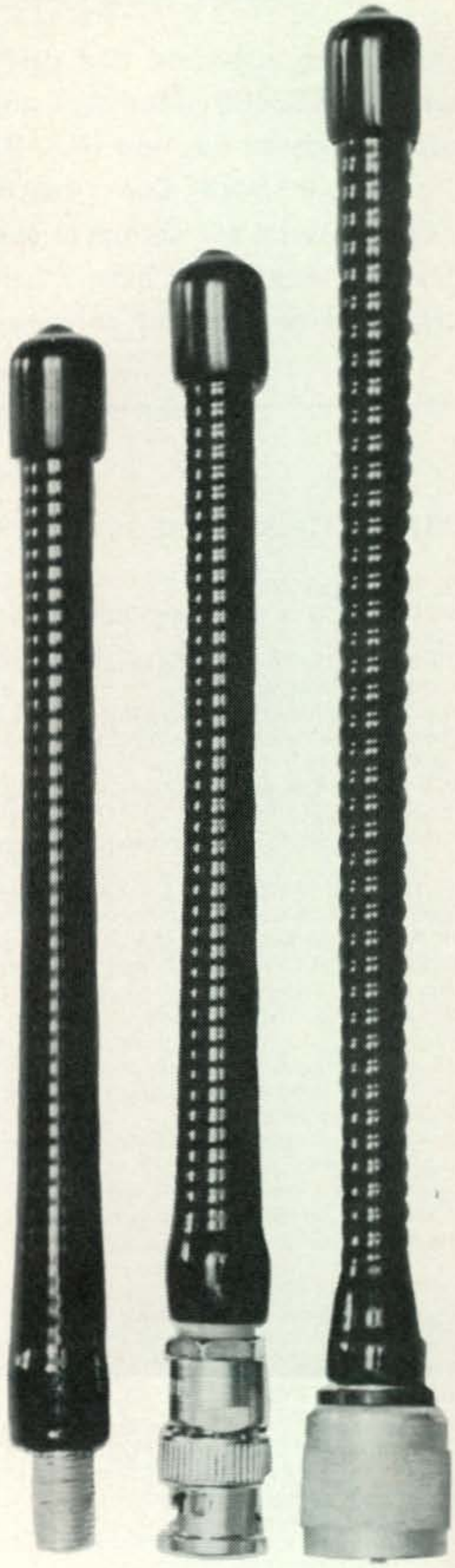

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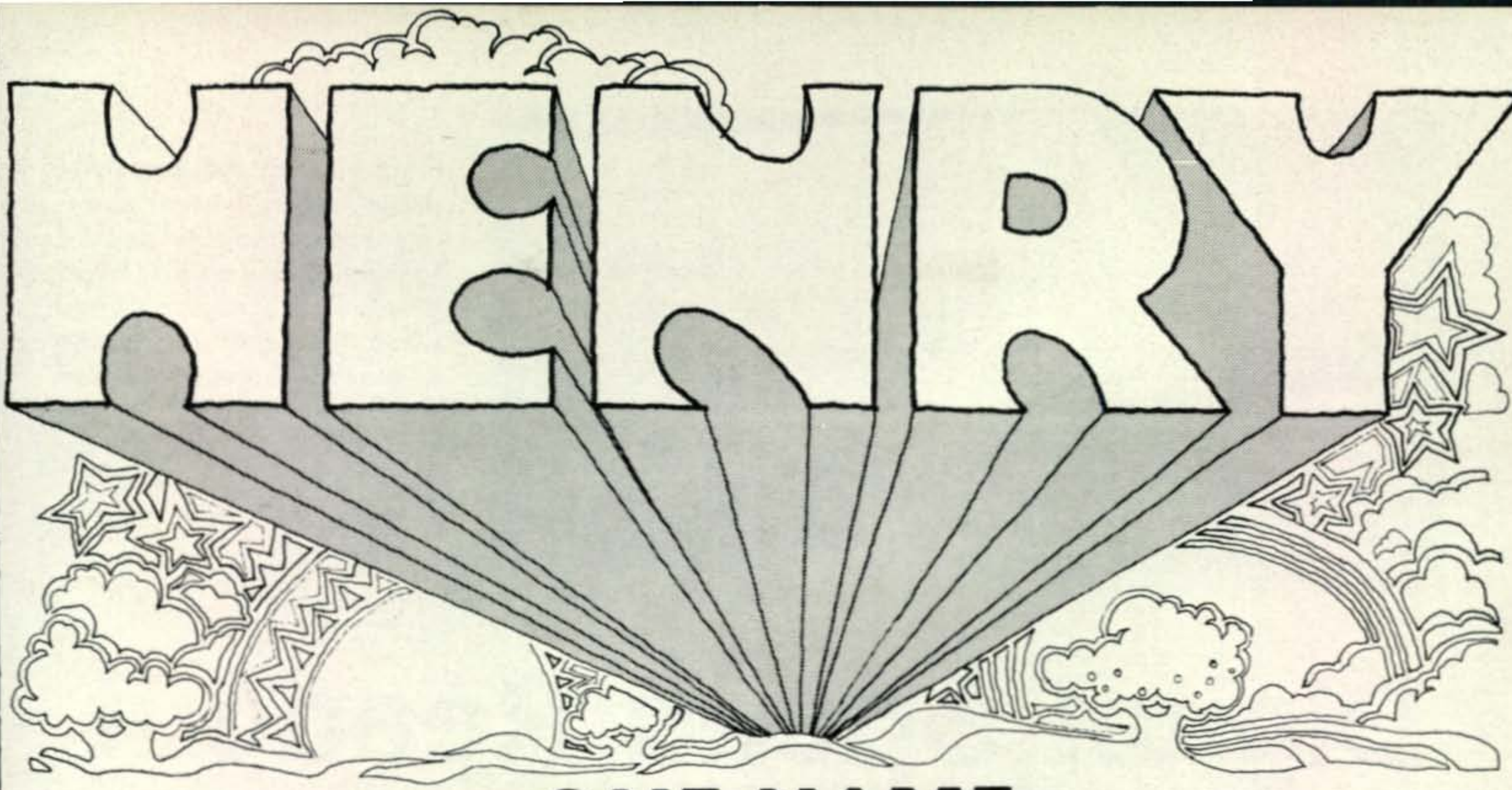

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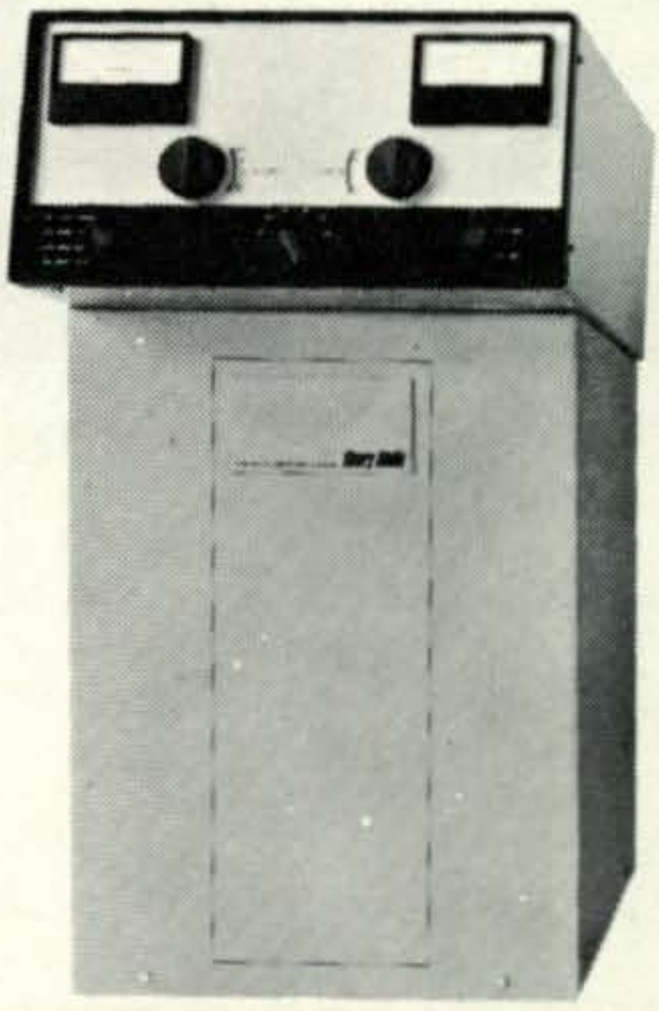

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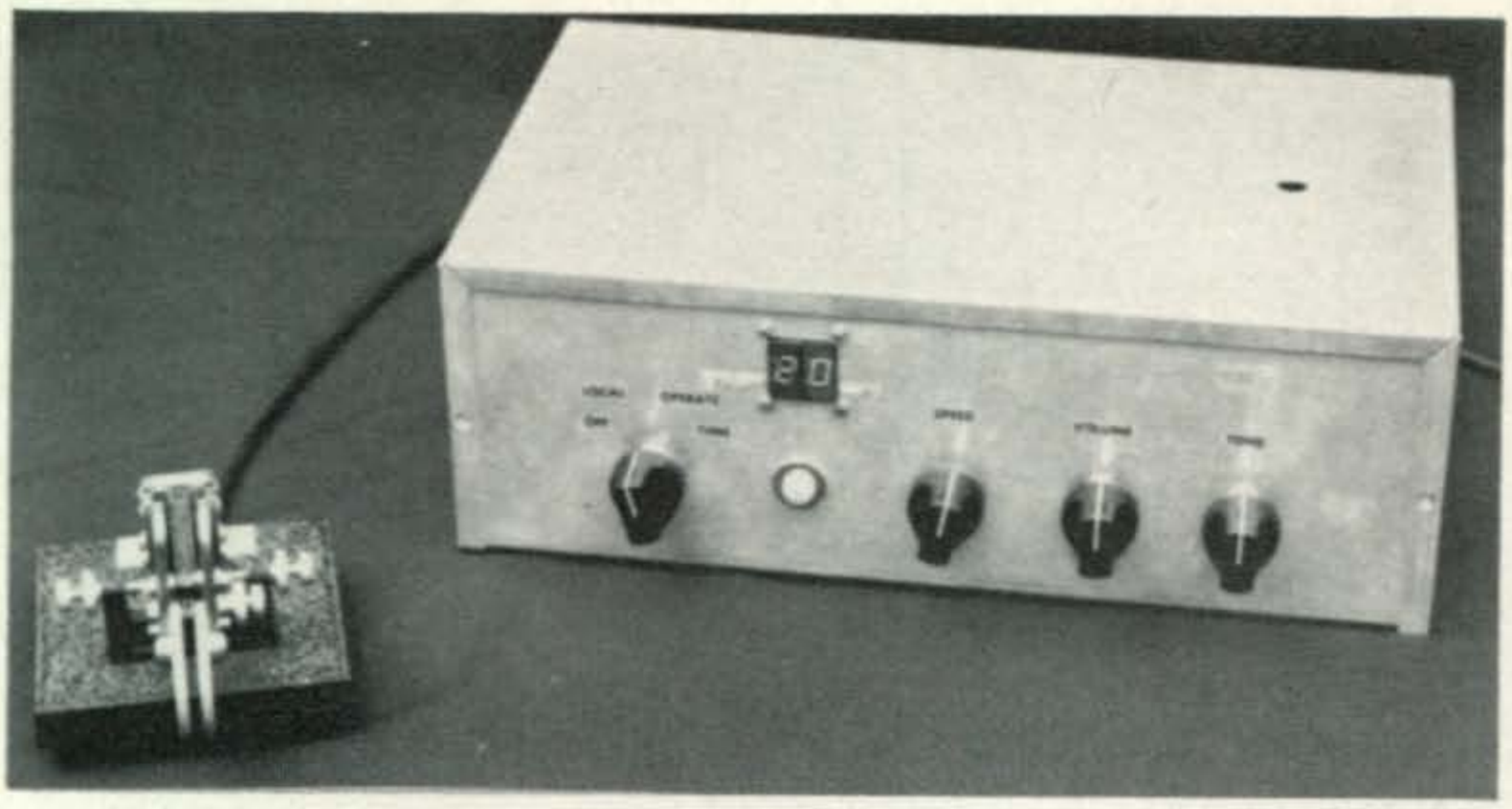


Front view of the prototype digital readout keyer showing control locations and functions. In use, the keyer displays the keying speed which the operator is sending at that time, and is updated every 1.2 seconds if the operator should increase or decrease his sending speed.

Digital Speed Readout In An Electronic Keyer

BY DON C. GILBERT,* WA2SKL/WA4SPD

HAVE you ever wondered exactly what speed you were sending? For instance, when preparing for the General exam you knew you could copy someone and send just as fast as him but you didn't know whether that speed was 15 or 10. This electronic keyer solves the problem because it provides a constant digital measurement of the speed you are sending, in words per minute. The measurement circuit can be adapted to other keyers, too.

Referring to fig. 1, the block diagram, we see that the basic keyer is Frank Van Cleef's "ICKEY,"[1] with automatic letter spacing.[2] This circuit has been redone for this keyer using the newer TTL logic, which is cheaper and more reliable than the old RTL. This circuit was chosen because of the dot and dash memories, which are both convenient and allow a free-

*10 Russet Rd., RD 1, Poughkeepsie, NY 12601

[1]Van Cleef, "ICKEY—An Integrated Circuit Electronic Keyer with Dot and Dash Memories," *QST*, Nov. '68.
[2]Van Cleef, "Automatic Letter Spacing for ICKEY," *QST*, Feb. '69.

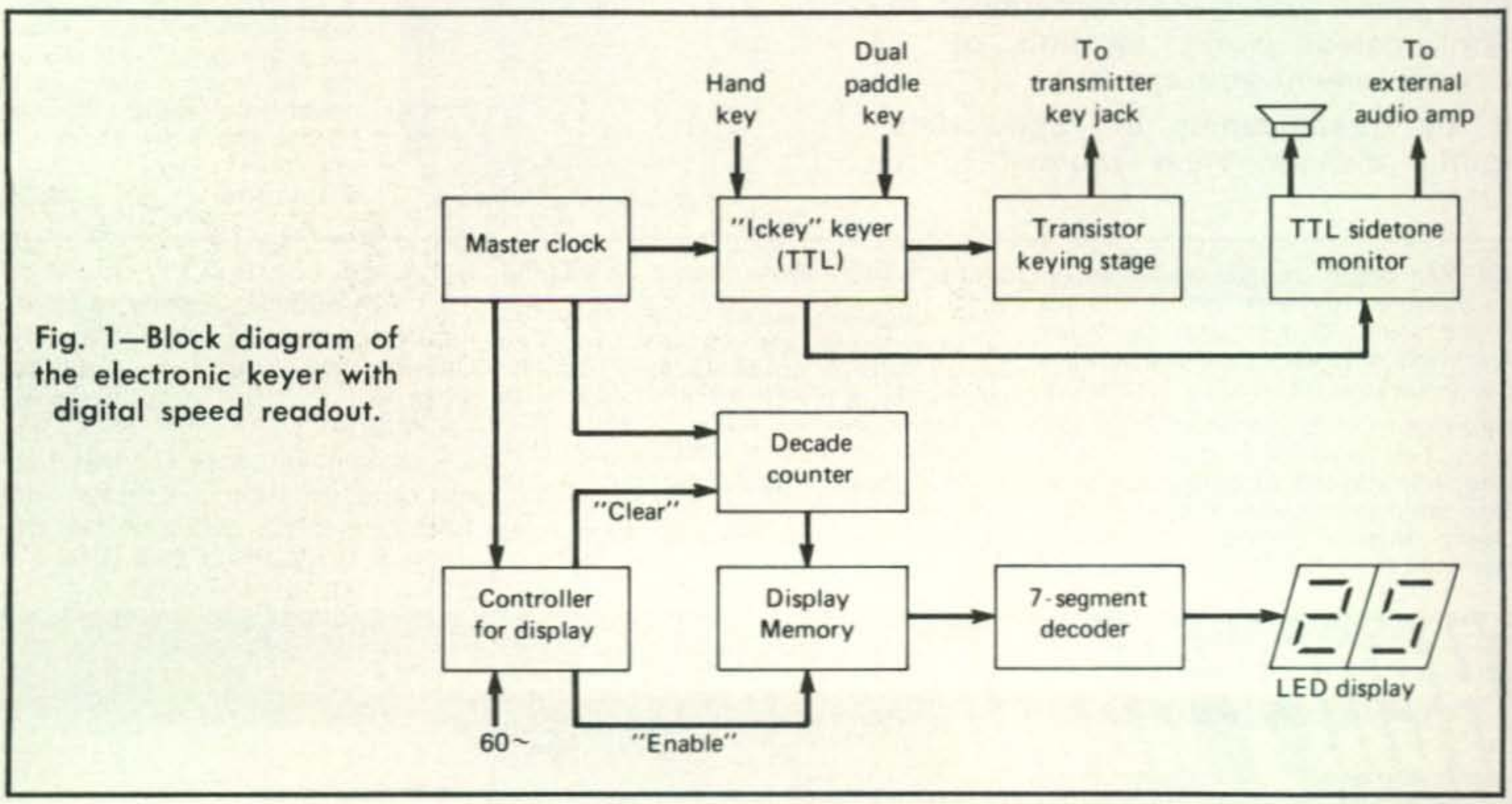


Fig. 1—Block diagram of the electronic keyer with digital speed readout.

running clock, which is necessary for the digital measurement. The master clock is really the heart of the whole circuit, because it not only drives the keyer but also is input to the digital measurement circuit. The clock is similar to the one used in the HAL 1550 keyer.[3] The output of the keyer is used to drive a sidetone monitor and a high voltage transistor keying stage, both also from the HAL 1550.

The digital measurement circuit is based on the formula from *The Radio Amateur's Handbook:*

$$Speed\ (\text{w.p.m.}) = \frac{\text{dots/min.}}{25}$$

This formula is based on standard values for "correct" c.w.: one unit pulse per dot, one unit pulse per space, three unit pulses per dash, and three unit pulses between letters. The ICKEY keyer will allow no other values, except a longer time between letters. Assuming that the operator is not waiting a long period between letters and words, the formula can be restated,

Speed (w.p.m.) = *Number of dots in 2.4 seconds.*

Since the master clock is running at twice the speed of the dots, (each master clock pulse is a "unit pulse" referred to above) all we have to do is count how many clock pulses appear in the space of 1.2 seconds and that number will be the speed in w.p.m. the keyer is sending. The digital measurement circuit does this by letting a decade counter count the pulses from the master clock for exactly 1.2 seconds (this period is obtained by counting, with another counter, 72 cycles from the 60 Hz line voltage), and then displaying that value. The display memory shown in the block diagram is necessary so that while the decade counter is counting, a constant number can be displayed. The output of the display memory is in binary coded decimal (BCD), required by the light-emitting diode (LED) readout. The result is a two digit display of the keying speed, which is changed every 1.2 seconds if the keying speed changes and otherwise stays constant.

[3]"HAL 1550 Electronic Keyer Instruction Manual," HAL Communications Corp., Box 365, Urbana, Illinois 61801.

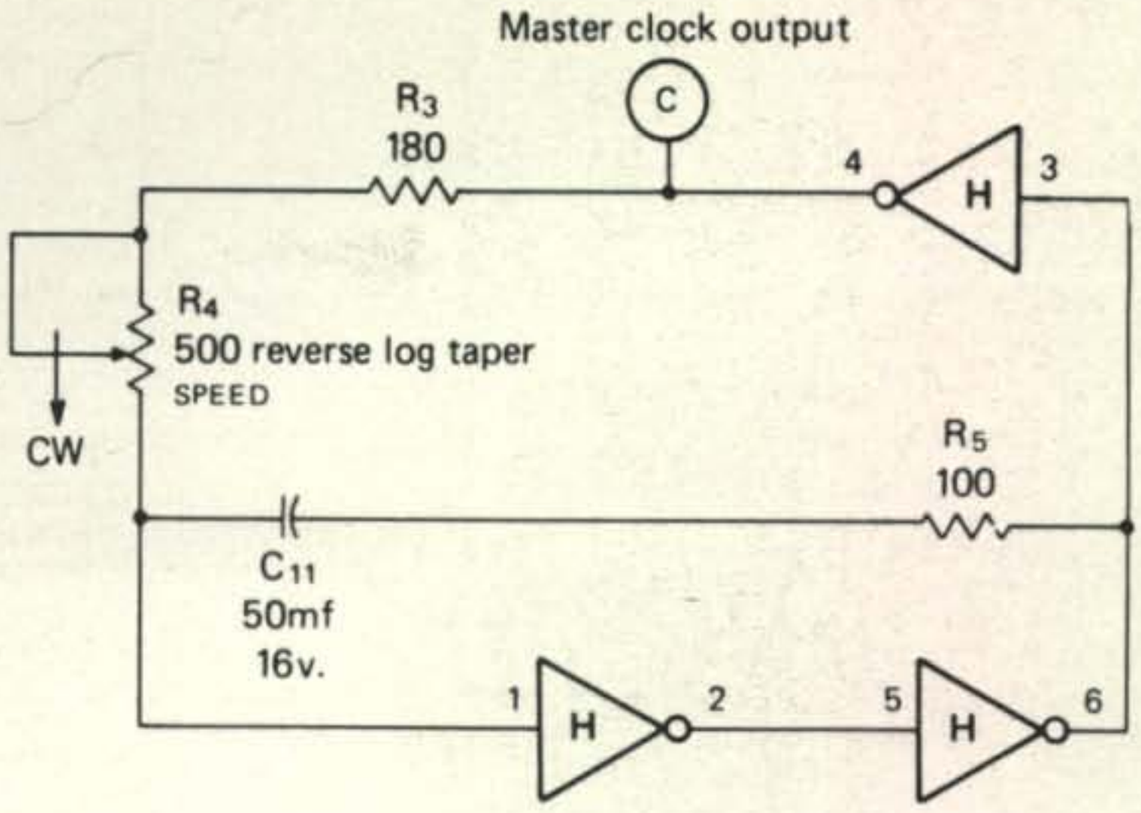


Fig. 2—Circuit of the keyer master clock (similar to that in the HAL 1550 keyer).

Master Clock

The master clock shown in fig. 2 produces square pulses which are "high" (over 3 volts) about half of each cycle and "low" (around ground) the rest of the cycle. Potentiometer R_4 varies the period of each cycle from about 20 milliseconds, or 60 w.p.m. to about 200 milliseconds, or 6 w.p.m. The value of R_3 may be adjusted to change the lowest and highest speeds. R_4 is reverse log taper to make the speed adjustment more linear.

Power Supply

The power supply shown in fig. 3 is designed to provide three voltages to the rest of circuit: 5.0 volts regulated for *V*cc in all integrated circuits plus the LED's, a "logic high" voltage for connection to all gate inputs which must always remain in the high state, and a 120 Hz square wave which drives the "controller" for the display. The 5 volt regulated is formed with

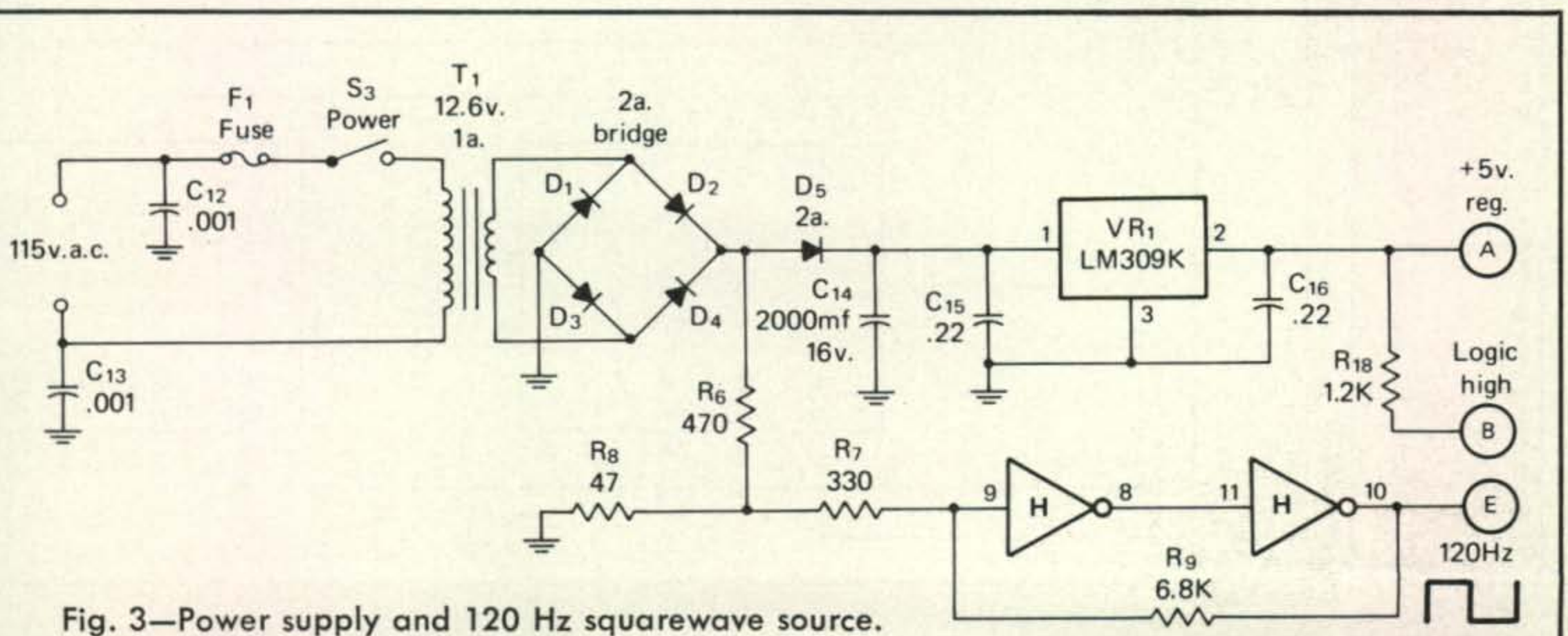


Fig. 3—Power supply and 120 Hz squarewave source.

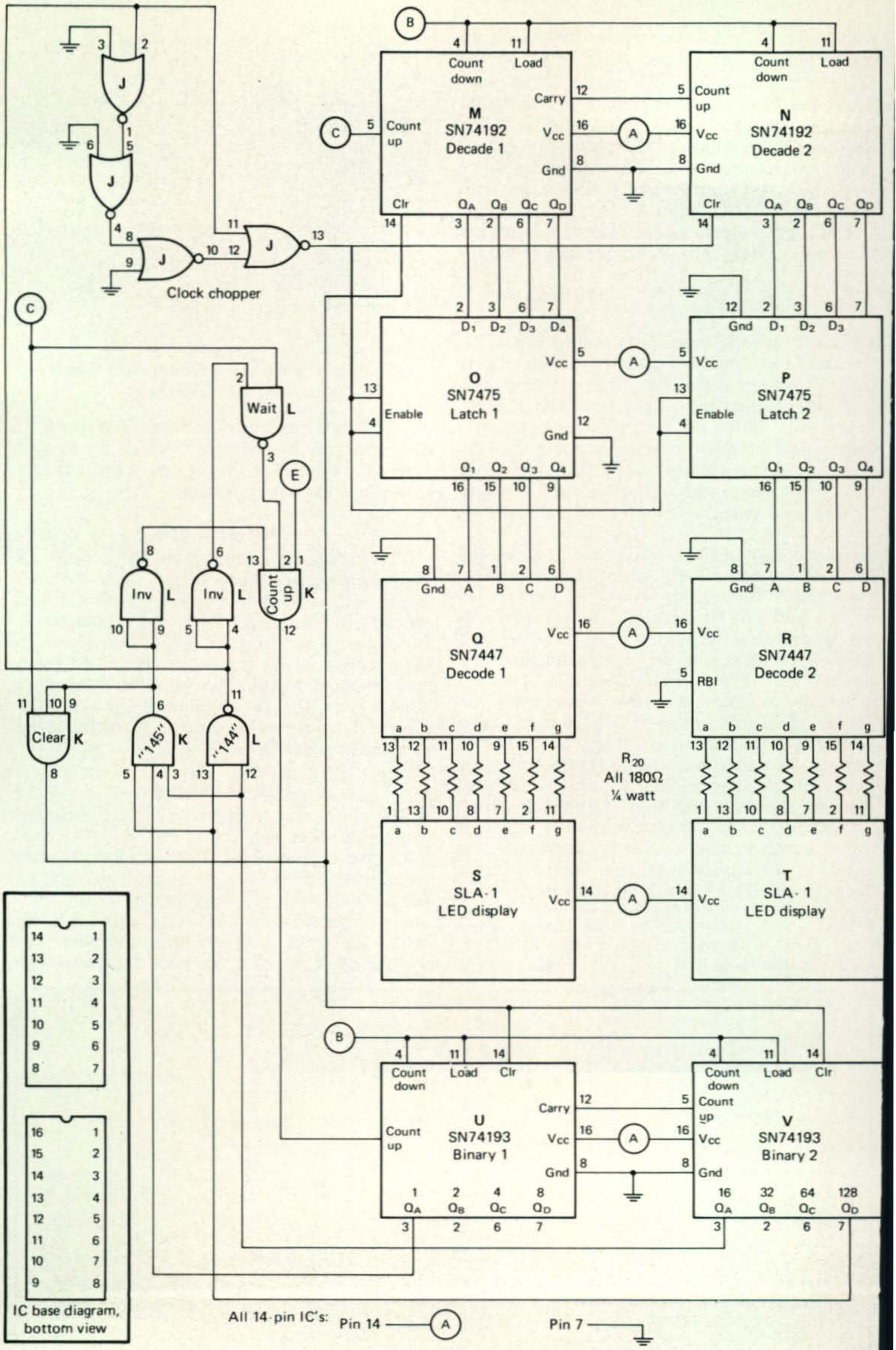

Clock chopper
Wait L
Inv L
Inv L
Count up K
Clear K
"145" K
"144" L
M SN74192 Decade 1
N SN74192 Decade 2
O SN7475 Latch 1
P SN7475 Latch 2
Q SN7447 Decode 1
R SN7447 Decode 2
S SLA-1 LED display
T SLA-1 LED display
U SN74193 Binary 1
V SN74193 Binary 2
R20 All 180Ω ¼ watt
IC base diagram, bottom view
All 14-pin IC's: Pin 14 — A Pin 7 —

Fig. 4—Display controller circuit. Circled letters in this and other diagrams refer to interconnections between circuit elements in figs. 2 through 6.

Table I—Integrated Circuits

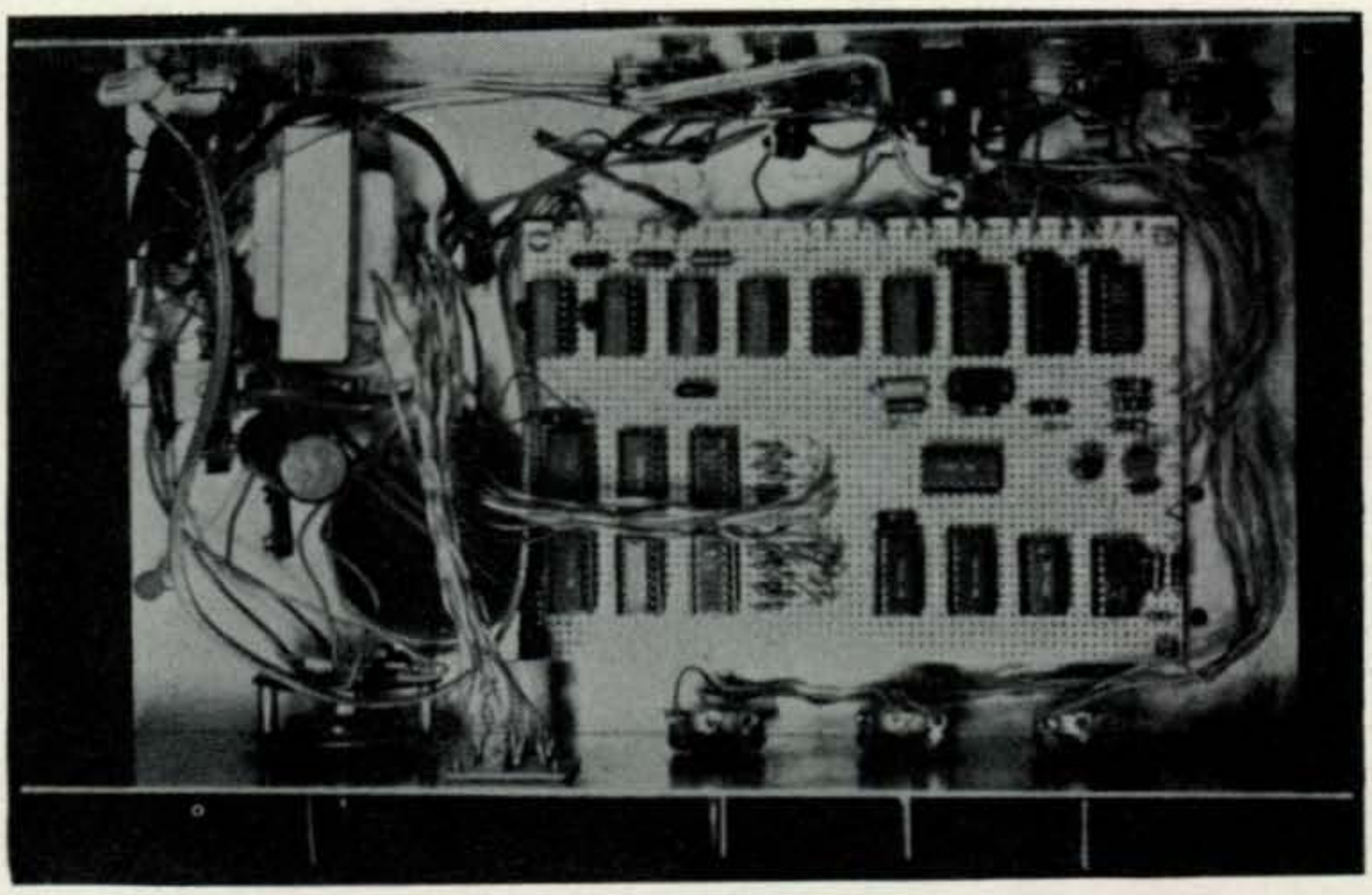
A, B, C, E, J, D	SN7402 Quad 2-input NOR. SN7425 Dual 4-input NOR with strobe.
E, G	SN7476 Dual JK M/S flip flop.
H	SN7404 Hex inverter.
I, L	SN7400 Quad 2-input NAND.
K	SN7411 Triple 3-input AND.
M, N	SN74192 Decode counter.
O, P	SN7475 Quad latch.
Q, R	SN7447 BCD-7 segment decoder/driver.
S, T	SLA-1 7-segment LED readout.
U, V	SN74193 Binary counter.
VR1	LM309K 5 v. 1 a. voltage regulator.

a 12 volt 1 amp transformer, a bridge rectifier and a filter, and an LM309K voltage regulator. Capacitors C_{15} and C_{16} are needed by the VR for transient protection. The "logic high" voltage is taken through a 1.2K resistor, R_{18}, connected to the regulated voltage. The 120 Hz square wave is formed by the "Schmitt trigger" circuit of R_6 through R_9, and the two inverters H. Diode D_5 is needed to isolate the Schmitt trigger from the power supply filter.

Digital Display

Referring to fig. 4, we see that the decade counter which counts the clock pulses is composed of the two IC's M and N. Each time a clock pulse changes from low to high, M counts to the next higher number. When it gets to 9, its "carry" line propagates the count to N. As long as the "clear" line (pin 14 on both M and N) is low, counting takes place on each clock pulse. When the "clear" line goes high, the count returns to zero. It is the function of the "controller" section, (J, K, L, U, V) to let the counter count and reset (clear) it at the proper times. The display memory is formed by IC's O and P: each contains four "latches" or memory elements. When the "enable" line (pins 13 and 4 on both O and P) is high, the outputs are the same as the inputs. But when the enable line goes low, the outputs stay as they are regardless of how the inputs change. This fact is used to provide a constant display: while M and N are counting, the enable line is held low so that the last speed is still displayed. But when the new 1.2 second count is complete, the enable line is brought high which lets the new speed show. If the new speed is the same as the old (which is always the case unless the operator is changing the speed pot) the display never changes.

Q and R are BCD to 7-segment decoders which convert the count from the display memory into the 7-segment enable lines a-g on each IC. When a certain segment is supposed to be lit, the corresponding line for that segment goes to ground potential, so *Vcc* conducts through the LED and current-limiting resistor to ground, lighting the segment. Opcoa SLA-1 LED readouts were chosen for this circuit because of their large size (.334" character size) and relative cheapness, but other LED's could be used by changing the values for the current-limiting



Interior view of the keyer showing parts placement. With the exception of the power supply, the entire keyer is built on a single piece of perfboard. Along the top of the board are the keyer and sidetone generator IC's while the master clock and display control IC's are at the bottom.

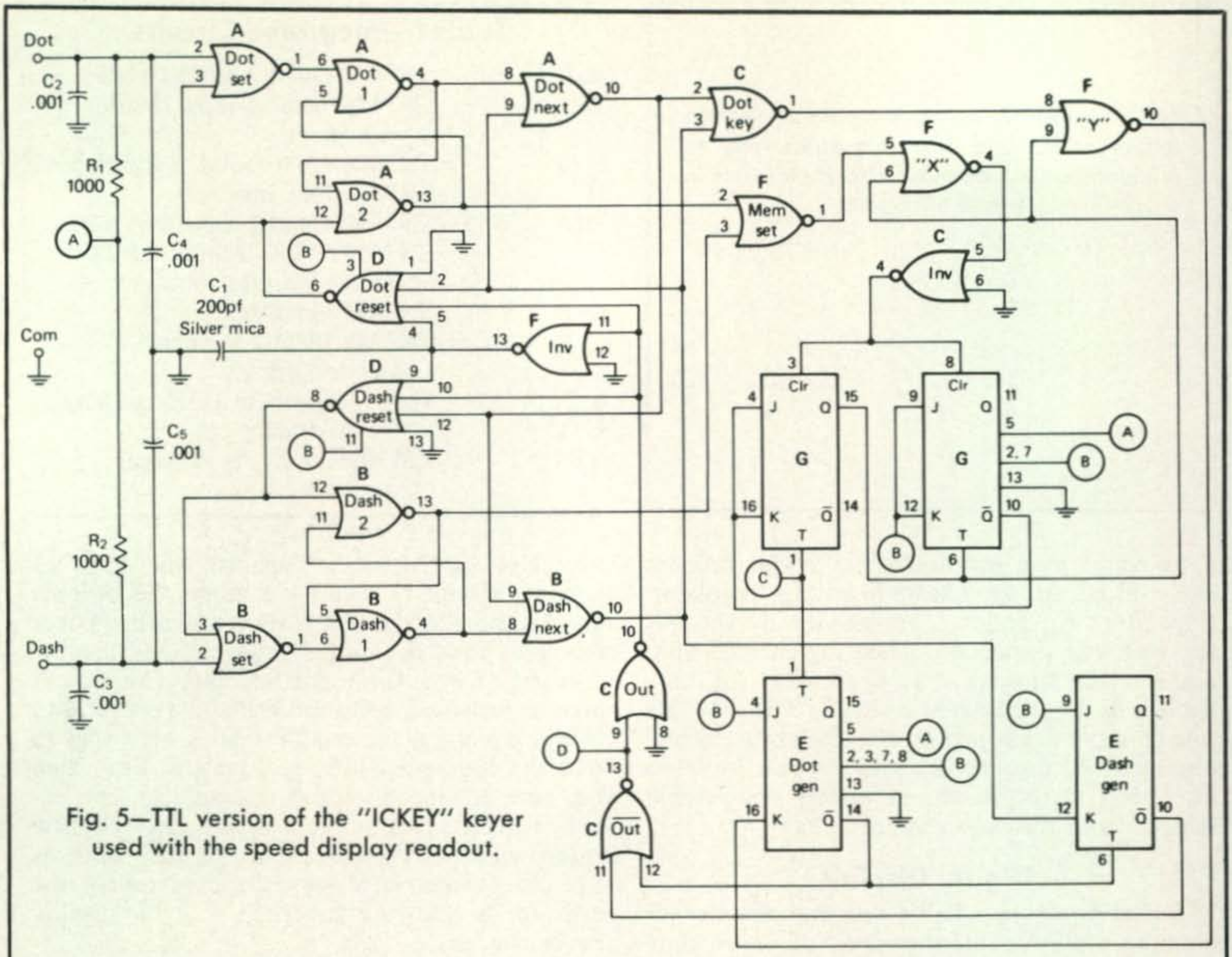


Fig. 5—TTL version of the "ICKEY" keyer used with the speed display readout.

resistors R_{20}.

The "controller" section shown in fig. 4 is the key to the operation of the digital display. Since it operates directly from the 60 Hz line voltage, it is usually very accurate and never needs adjustment. This means that even if the digital display is used with a keyer whose speed drifts considerably, the display will always show the exact speed at which the keyer is running.

Normally, pins 2 and 13 of COUNT UP are high, allowing the 120 Hz square wave to count the binary counters U and V. During this time, pin 8 of CLEAR is low allowing the decade counters M and N to count the clock pulses, and pin 13 of J is also low, keeping the changing count from affecting the value displayed from the memory O and P. When pin 3 of V *and* pin 7 of V go high, indicating that a count of 144 120-Hz pulses, or 1.2 seconds, has been reached, pin 11 of "144" goes low, which does two things. First, this low is inverted to a high on pin 2 of WAIT, which inhibits COUNT UP from letting the 120 Hz square wave through to count up U until the clock pulse is in a *low* state. Second, the low from "144" causes pin 13 of J to go high, letting the count from the decade counters M and N go into the memory O and P and be displayed. If this enable were left high too long, the decade counters would continue counting and the display would change. So the "clock chopping" circuit on IC J is used to turn the high on pin 13 of J back off after about 30 nanoseconds, just enough time for the count to get through the memories O and P. This circuit is really a 30 ns monostable multivibrator.

Once the clock goes into a low state, the COUNT UP gate lets the 120 Hz through and U and V count one more pulse, up to a count of 145. But at this point, pin 3 of U and pins 3 and 7 of V all become high which drives pin 6 of "145" high. This causes pin 13 of COUNT UP to go low, inhibiting any more counting in the binary counters, and also brings high pins 9 and 10 of CLEAR. The circuit was not allowed to count to 145 until the clock pulse was in a low state, so at this point the circuit waits until the clock pulse becomes high again. When it does, pin 8 of CLEAR goes high, clearing both the decade counters M and N and the binary counters U and V. This in turn makes pin 6 of "145" go low again, and all counters start counting from zero.

The critical feature in the design is that because of the gates WAIT and CLEAR, the controller always starts both counters (binary and decade) at the very moment the clock pulse goes from low to high, and never at any other point within the period of the clock pulse. This means that the 1.2 second period always counts

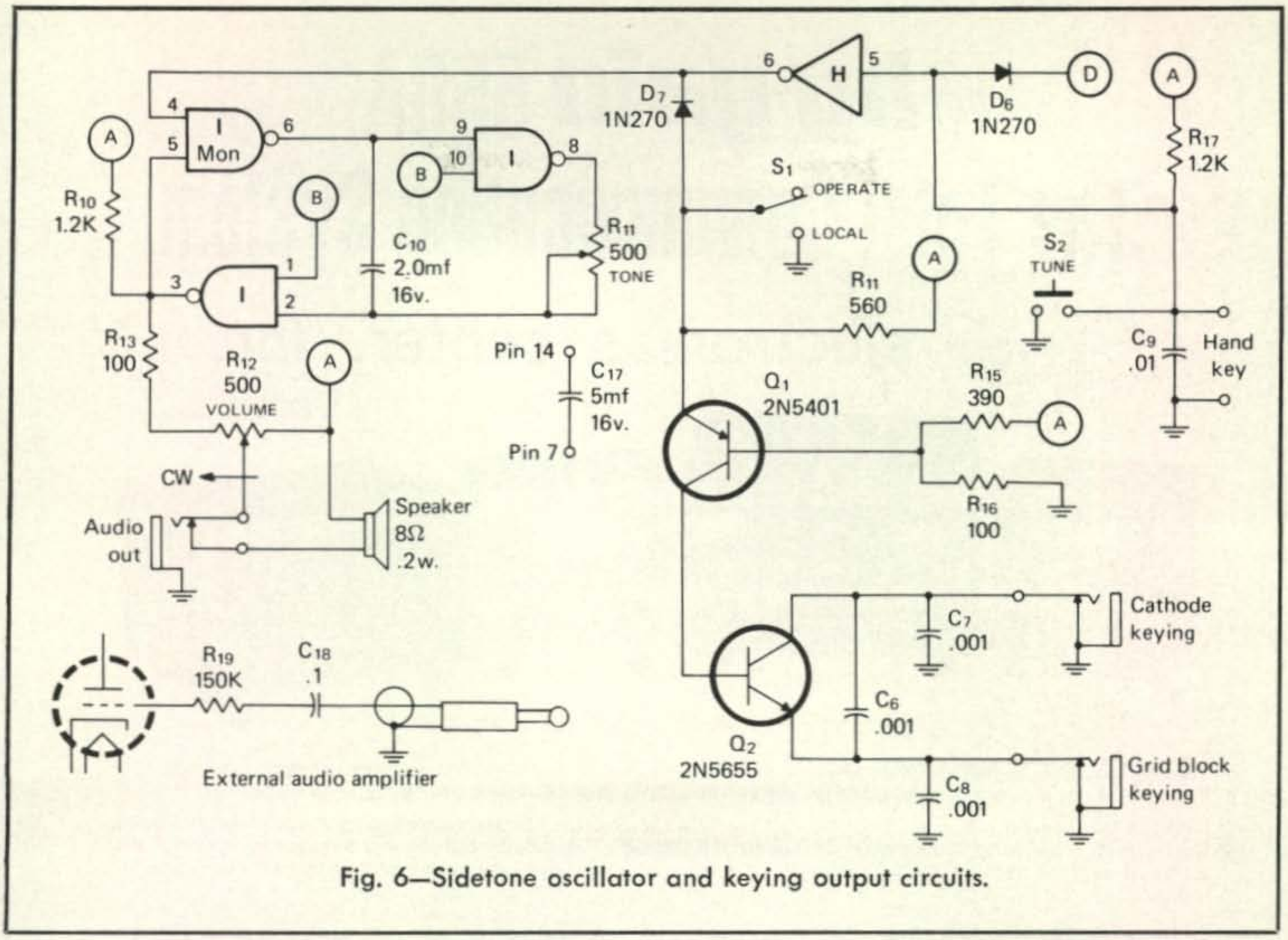


Fig. 6—Sidetone oscillator and keying output circuits.

the same number and last digit "jitter" is eliminated.

Keyer

As shown in fig. 5, the keyer circuit is the same as Van Cleef's ICKEY, except that the logic used is TTL. A comparison with the original circuit will show that the flip flops (G and E) are connected differently. This is due to a difference in function between the RTL IC's (which toggled, or reversed states, when both J and K were low) and the TTL (which toggles when J and K are high). The bypassing here and in the other circuits is necessary to prevent r.f. interference.

Sidetone Monitor

Referring to fig. 6 we see that the sidetone monitor oscillator, I, is similar to the master clock, except that it is turned on and off by gate MON. Pot R_{11} controls the frequency of oscillation. The speaker is driven directly by the IC, so capacitor C_{17} is connected directly from Vcc to ground on I to improve regulation. An external audio amplifier may also be driven, such as the audio stage in a receiver, but coupling capacitor C_{18} should be used if one is not already present in the circuit, and R_{19} should be used for isolation.

Keying Stage

The keying stage is also shown in fig. 6. Diode D_6 and resistor R_{17} allow a hand key and the tune switch to be connected to drive the output. The diode D_6 isolates the hand key from the keyer circuit. Resistor R_{17} allows pin 5 of H to follow the level of pin 13 of OUT, but keeps from shorting Vcc to ground when the hand key is closed.

Switch S_1 defeats the output stage in the "local" position, allowing the operator to practice with the keyer while it is connected to the transmitter without keying the transmitter. In the "operate" position, Q_1 acts as a common-base amplifier to drive Q_2 from non-conduction into conduction. Q_2 can key either (but not both) a positive voltage to ground, like a cathode-keyed transmitter, at a maximum of 250 volts, 100 ma, or a negative voltage to ground, like a grid-block keyed transmitter, at a maximum of −150 volts, 100 ma. If the transmitter to be keyed has a shaping capacitor across the keyed line, a resistor should be selected which does not affect the keying of the transmitter and put in series with the keying line.

Construction

The entire keyer, except power supply, fits nicely on Vector 64P44-062EP 6.5″ × 4.5″ prepunched board. IC sockets were used for convenience in experimentation, but are not necessary. Vector Zip terminals (T42-1) proved convenient in making connections on the board as well as connections to points off the board.

[*Continued on page 71*]

hy-gain 550A

The Total Communication System

From electronics center, inc.
Dallas

The Hy-Gain 550A is the complete amateur system. Designed from the ground up to work together for total performance. Each element is matched to the system, for simple, plug-in expansion of your capabilities.

GT-550A Transceiver The matchless heart of the 550A System. No other transceiver can give you this performance for the price. Operating fixed station or mobile, the GT-550A is guaranteed to have top frequency stability after warm-up. A graph showing stability during final check-out is included with each unit. 25 KHz calibrator and VOX, optional.

Frequency Coverage—3.5-4.0, 7.0-7.5, 14.0-14.5, 21.0-21.5, 28.0-29.0 MHz crystals supplied. Other 10 meter coverage optional. Power Output—300 watts PEP (nominal) on SSB, 180 watts on CW and RTTY, into 50 ohm resistive load.

Harmonic and Spurious Radiation—Carrier suppression in excess of 45 db down, unwanted side bands minus 55 db oscillator feed through and mixer spurious products down 50 db. Second harmonic minus 40 db and third order distortion in excess of minus 45 db.

Noise Level—In excess of 40 db below single tone carrier.

Audio Frequency Response—Minus 6 db approximately 300/2400 Hz determined by side band filter.

RF Compression Characteristics—Up to 10 db RF compression without distortion.

Receiver Sensitivity—Better than .5 uv for 10 db S+N/n ratio.

Receiver Selectivity—2.1 KHz with 1.8 shape factor for SSB or 300 Hz sharp selectivity with optional CW filter.

Receiver Spurious Response—Image rejection better than 40 db down. Internal spurious below 1 uv equivalent input.

Frequency Calibration—Interpolation to 1 KHz in 5 KHz increments.

Frequency Stability—Within 10 Hz during any 30 minute warm-up period, less than 100 Hz in any 15 minute warm-up period, not more than 100 Hz with a plus or minus 10% line voltage variation.

Calibration Accuracy—Interpolation to 1 KHz after calibration.

Back Lash—Not more than 50 Hz.

Output Impedance—Variable 50 ohms nominal capable of matching up to 2-1 SWR (30-100 Ohms).

Automatic Volume Control—Fast attack, slow release on all receiver modes.

Order No. 855

RF550A contains high accuracy watt meter; calibrated in 400 and 4,000 watt scales; switch for forward or selected power; switch to select 5 antennas or dummy load. Order No. 857

RV550A is a solid state VFO. Function switch selects the remote unit to control Receive-Transceive-Transmit frequency independently. Order No. 856

SC550A Speaker Console with headphone jack. AC400 power supply will mount inside. Order No. 858

AC400 Power Supply is heavy duty solid state to operate GT-550A at full power, on SSB or CW, and with switch selection of 115/230 VAC, 50/60 Hz input voltages. Order No. 801

G-1000 12V D C Mobile power supply with cables. Order No. 802

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Results of the 1974 CQ World Wide WPX SSB Contest

BY BERNIE WELCH,* W8IMZ

THIS was a good one—providing the measurability of "good" is based upon the total number of logs received. The eighteen percent increase over last year's number of logs would certainly justify this.

Activity by a considerable number of unique prefix goodies, such as the large number of PS and PT1's thru 9's, provided by the Brazilians, along with U5, HG8, VX1, and 2, WS7, PI1, FPØ, EI1, CV2, VA6, WM5, 4JØ, CQ6, LH2, RI8, XX6, RB5 and LAØ helped make this contest a success, even though band conditions continued to deteriorate. Many stations missed taking the extra multiplier for WA2KGY/4X, which counts as 4XØ for WPX.

Around the clock pile-ups were attributed to semi-rare DX stations XU1, A51, PJ9, 5B4, ZB2, JD1, VP5, HV3, 9M2, OD5, CR4, CR5 and EA6, 5Z4 and CN8.

PJ9JR came through with the high score of the contest and won top world honors in the multi-operator, single xmitter category. Jack, W3ZKH and Ray, WA3IAQ DXpeditioned to Curacoa, Netherlands Antilles especially for this contest. Jack commented, "had plenty of everything except sunspots. Conditions were marginal at best, but enjoyed every QSO." Some of the other expedition stations were: VP2EEC, VP2GGG, FPØBG, 5Z4OY/A, JD1YAH, and VP5CW. We expect to have a special trophy award made available starting with the '75 contest for the top scoring station in this category (multi or single transmitter) provided there is increased participation and three or more groups continue to submit their logs.

K6UA is the winner of the single-operator all band W4OPM Memorial Award. Dale did an excellent job of racking up 665,808 points from California. In keeping with *CQ* policy of not awarding a major trophy to the same station two years in succession, W2PV will be awarded a special *CQ* Award for USA high score.

The only 160 meter entry was WB8APH. Wallace is congratulated for his efforts. Wish we had more WPX activity on this band.

W6ONV operated by WA9UCE is an all-time high 14 mHz score for California, under the current WPX contest rules, and second only to W3AU in this year's stateside competition. Thanks for all the extra activity and logs received from the west coast. In fact, there was an increase from the 2nd, 4th thru 7th and 9th US Districts and it is appreciated. Also how about that big increase in the number of world wide multi-operator, single transmitter stations? Could this indicate a trend?

Before we became engulfed in a stack of mail questioning the listing of UK6APA I feel clarification is in order. The log clearly states that they operated on the top of an 1100 ft. mountain, near the Black Sea within Asiatic Russia. Most stations did not take the correct number of points for this one since USSR normally assigns a call like this to Europe.

LU5HFI operated by F5QQ is probably the final contest activity for that station. Ron indicates he may be operating from an exotic African location in next year's event.

The 10 meter score of CE6EZ was limited only by the amount of activity on that band because according to Ralf, the band was wide

This is Kohsaku, JD1AJD/JA7KAC operating JD1-YAH, who along with 5 other Japan DX Association ops made Ogasawara Island and the rare JD prefix available with over 2700 completed contest QSOs.

*7735 Redbank Ln., Dayton, Ohio 45424

TROPHY WINNERS

WORLD—Single Operator, Single Band. Jack Reichert, W3ZKH Trophy. Won by: **Club Station YU2CDS.** (Opr. Davor Milosevic, YU2RNC, 14mHz).

WORLD—Single Operator, All Band. Don Murray, K4FMA Trophy. Won by: **Victor Manuel Ramos Pereira, CQ6LF.**

WORLD—Multi-operator, Single Xmtr. Ted Thorpe, ZL2AWJ Memorial, awarded by Don Miller, W9WNV. Won by: **Station PJ9JR.** (Oprs. W3ZKH, and WA3IAQ.)

WORLD—Multi-operator, Multi Xmtr. Chuck Swain, K7LMU Memorial awarded by Don Miller, W9WNV. Won by **Station CV2T.** (Oprs. CX1BBL, CX3BH, CX4AAC, CX4CR, CX8BBH, CX9BT.)

CANADA—Single Operator, Single Band. Gene Krehbiel, VE7DKS Trophy. Won by: **Station VX2AS.** (Opr. Stan L. Parsons, VO2AS, 14 mHz.)

U.S.A.—Single Operator, All Band. Charles "Joe" Hiller, W4OPM Memorial, awarded by Jerry Hagen, WA6GLD. Won by: **Dale Hoppe, K6UA.**

U.S.A.—Single Operator, Single Band. Charles "Joe" Hiller, W4OPM Memorial, awarded by The Virginia Century Club. Won by: **Station W3AU.** (Opr. Robert G. Cox, K3ESI, 14 mHz.)

SPECIAL CQ AWARD—Station W2PV

open. G3JUL indicates this was his first appearance on the contest scene for over ten years. I'm sure happy he picked the WPX to get back in the action, as did Gordon, VK2OW, an old timer on c.w. who acquired an s.s.b. rig just in time to work his very first phone contest.

Brother Ed, HV3SJ had planned a multi-operator weekend, but due to circumstances, went it alone and gave many a new and much sought after prefix. Is it possible that the HV1 prefix could be activated for the next one?

The North Florida DX Association's VP5CW operations stirred up a lot of activity for stations seeking new countries. That was a FB effort and I'm sure all WPXers appreciate it.

The VA6 prefix used by the Wizard Lake DX Club station VA6WDX was assigned to celebrate 100 years of RCMP in Alberta. Here in the USA, the special WM5BIL call was assigned to celebrate the 275th anniversary of the founding of the city of Biloxi, Mississippi and was operated by the Mississippi Coast Amateur Radio Association, and thanks to K5YIN for supplying the information. WS7MVM was a special event operation by the Boeing Employees Amateur Radio Society to mark man's first two planet missions, the Venus and Mercury encounters. The call ZB2WPX did not just happen. It was only through the efforts of Jimmy ZB2BL, assisted by ZB2CX that this special call was activated for the contest period.

I imagine that some of you who have made suggestions for changes in rules, dates, etc., feel that they are given low priority. However, I assure you each suggestion is carefully considered by the committee. In a world-wide event the rules must be as fair as possible for all areas of the world and stability of dates is most necessary. It takes a few years to determine if changes are in the best interest of all contestants.

Now is the time to make your plans for the

[*Text continued on page 70*]

TOP SCORES

SINGLE OPERATOR ALL BANDS

CQ6LF	**1,936,938**	LU8AJG	1,072,500
CN8BO	1,907,880	KS6DH	1,046,446
LU5HFI	1,780,600	5Z4OY/A	958,353
YV6AW	1,673,660	**W2PV**	**878,738**
KH6RS	1,235,208	VP2GGG	836,565
CX1JM	1,216,212	DK8FZ	822,617

SINGLE OPERATOR SINGLE BAND

28 mHz

CQ6OR	424,815
CE6EZ	266,668
YV4YC	73,260
JR1INZ	43,733
4X4QG	41,736
K6SVL	24,278

21 mHz

CR6OZ	661,680
KH6IJ	270,060
K6SDR	231,150
WB6EJV	158,130
WA6QFY	153,153
PY1BDU	148,035

14 mHz

YU2CDS	**845,568**
W3AU	**724,822**
DK1FW	510,402
UJ8JGJ	509,787
KH6GMP	477,246
SM1CNS	455,445

7 mHz

OH2KI	259,440
W6PAA	253,946
K6OVJ	247,866
I4BMJ	180,958
K5PFL	171,520
W6RTT	135,044

3.8 mHz

YU4EBL	244,818
I3MAU	215,940
DL8PC	208,278
YV4TI	176,064
OH1XX	170,624
HA4KXC	143,040

MULTI-OPERATOR

Single Transmitter

PJ9JR	**4,543,618**	PS7BDX	2,519,700
PY2CAB	3,647,904	UK6APA	2,094,666
4X4NJ	2,845,905	VP5CW	2,000,985
UK9ABA	2,530,098	YU1BCD	1,613,920

Multi Transmitter

CV2T	**2,859,213**	SK5AL	1,031,916
SV1GA/5B4	2,819,945	JD1YAH	678,679

U.S.A. TOP SCORES

Single Operator

All Band W2PV 878,738
28 mHz K6SVL 24,278
21 mHz K6SDR 231,150
14 mHz W3AU 724,822
7 mHz W6PAA 253,946
3.8 mHz W7YTN 85,888
1.8 mHz WB8APH 504

Multi Operator

Single Xmtr. WA6GLD 137,250
Multi Xmtr. W5NOP/5 279,720

nber groups after call leter otes: Band, Score, QSO's and fixes. Bold listings are certifi- winners.

INGLE OPERATOR

North America

United States

SJ	**A**	**509,694**	**765**	**263**
STN	"	74,448	230	132
MDO	"	12,608	83	64
GYE	14	630	17	15
WY	**7**	**2,244**	**34**	**33**
PV	**A**	**878,738**	**956**	**322**
		(Opr. WB2SQN)		
EAH	"	228,684	428	204
EJ	"	43,320	144	114
JJN	"	38,658	154	102
QO	**14**	**325,945**	**546**	**235**
ECC	"	32,103	135	87
UR	"	3,840	45	40
WR	**3.8**	**66,608**	**237**	**92**
IN	"	63,518	210	91
FGA	"	4,320	62	40
VM	**A**	**12,871**	**86**	**61**
HR	"	2,988	43	36
ZD	**28**	**11,715**	**90**	**55**
HRV	**21**	**75,190**	**218**	**146**
U	**14**	**724,822**	**823**	**322**
		(Opr. K3EST)		
VUC	"	79,497	256	121
OL	"	78,952	214	139
RE	**7**	**10,560**	**122**	**55**
VRY	**A**	**177,300**	**265**	**170**
FQ	"	81,420	238	138
SIJ	"	46,560	157	120
TBO	"	43,641	159	117
D	"	24,645	123	93
DT	"	17,352	104	72
A	"	13,561	90	71
YC	"	8,320	67	52
MS	"	6,528	63	51
RUA	"	455	16	13
ZF	**28**	**4,738**	**73**	**46**
SF	**21**	**67,536**	**216**	**134**
YC	"	20,501	107	83
KJ	**14**	**51,062**	**164**	**121**
GL	"	50,173	170	131
TPU	"	17,025	89	75
EO	"	1,725	25	25
JK	"	176	8	8
APG	**7**	**9,100**	**57**	**50**
STI	**A**	**67,564**	**259**	**133**
E	"	50,941	212	121
ZWC	"	25,920	140	96
PO	"	25,480	139	98
B	"	3,616	41	32
KWU	"	2,898	67	46
EC	"	1,908	41	36
GYF	28	102	6	6
TQ	**21**	**33,633**	**152**	**101**
FKX	"	11,160	80	62
KD	"	1,440	26	24
LES	**14**	**111,687**	**322**	**177**
FL	7	171,520	348	128
LUM	"	15,000	139	75
VDH	**3.8**	**13,600**	**120**	**68**
K6UA	**A**	**665,808**	**1007**	**208**
W6UFJ	"	225,318	516	141
W6BJB	"	106,560	364	111
WA6MWG	"	51,290	168	115
W6KYA	"	28,475	148	67
WA6WUI	"	22,344	122	98
WA6NBY	"	21,128	110	76
WA6TKT	"	14,896	117	76
W6YVK	"	10,948	81	68
W6SC	"	10,797	73	61
W6CLM	"	7,304	64	44
K6SVL	**28**	**24,278**	**150**	**61**
K6SDR	**21**	**231,150**	**678**	**115**
WB6EJV	"	158,130	530	105
WA6QFY	"	153,153	474	119
W6ONV	**14**	**406,087**	**749**	**209**
		(Opr. WA9UCE)		
W6AM	"	27	3	3
W6PAA	**7**	**253,946**	**473**	**119**
K6OVJ	"	247,866	495	109
		(Opr. WB6VZI)		
W6RTT	"	135,044	326	98
WA6UFY/6	"	88	11	11
VE63DXV/W6	**3.8**	**50,736**	**171**	**84**
WA7MEO	**A**	**392,570**	**751**	**185**
W7JUO	"	10,374	70	57
K7IDX	"	**28,390**	**45**	**13**
W7EXM	"	15	9	5
K7RSC	**14**	**284,410**	**664**	**170**
VE7ZZ/W7	"	214,970	514	166
WS7MVM	"	71,478	501	114
W7AYY	"	27,058	148	83
W7YTN	**3.8**	**85,888**	**262**	**88**
W8IMZ	A	38,098	158	101
K8PYD	"	60	5	5
W8KOD	**21**	**4,212**	**51**	**39**
WA8TBQ	**14**	**249,075**	**433**	**225**
W8CNL	"	58,646	178	142
WA8VMQ	**7**	**50,400**	**190**	**100**
WA8LXJ	"	19,760	96	76
WB8HLI	"	832	66	32
K8DVV	**3.8**	**36,792**	**302**	**73**
W8FJS	"	4,128	57	43
WB8APH	**1.8**	**504**	**60**	**21**
W9LT	**A**	**227,880**	**427**	**216**
WB9EBO	"	30,870	114	98
K9CLO	"	19,872	119	92
K9EGA	**21**	**10,850**	**86**	**62**
K9TZH	**14**	**254,421**	**413**	**243**
W9IY	"	222,444	405	222
W9YRA	"	66,360	200	140
WA9HEU	**7**	**13,728**	**95**	**66**
WB9HAD	"	10,303	119	59
WB9IND	"	1,140	38	30
WAØVPN	**A**	**20,672**	**121**	**76**
KØPMZ	**7**	**14,400**	**135**	**72**
WA2WMT/Ø	"	13,640	77	62
WAØEMS	"	7,080	114	60

Anguilla

VP2EEC	**A**	**93,522**	**347**	**109**
		(Opr. K2FJ)		

Bermuda

VP9AD	**A**	**155,700**	**314**	**150**
VP9GO	**14**	**425,220**	**734**	**228**

Canada

VE1RQ	**14**	**72,485**	**225**	**133**
VX1AW	**A**	**106,492**	**248**	**158**
VX2AS	**14**	**281,060**	**662**	**188**
VE3GCO	**A**	**45,156**	**169**	**106**
VE3BBH	**14**	**232,988**	**469**	**212**
VE3FLE	"	173,106	384	177
VE3CBY	"	86,319	245	139
VE3GFY	**7**	**34,902**	**141**	**63**
VE3BBN	**3.8**	**33,642**	**148**	**63**
VE4RP	**A**	**41,230**	**156**	**95**
VE4ZP	**14**	**56,499**	**234**	**111**
VE6AGV	**A**	**69,700**	**266**	**100**
VE6SB	"	41,943	198	93
VE6MP	**14**	**59,055**	**293**	**93**
VE6MC	3.8	1,188	23	18
VE7IQ	**A**	**10,824**	**121**	**33**
VE8OO	**14**	**37,582**	**195**	**86**

Canal Zone

KZ5BC	**A**	**697,632**	**1267**	**208**
KZ5NG	"	**615,020**	**1260**	**191**
		(Opr. KZ5BP)		

Costa Rica

TI2SW	**14**	**58,604**	**270**	**98**

Dominican Republic

HI8XAW	**A**	**251,370**	**755**	**147**
HI8LC	**14**	**110,433**	**360**	**131**

Grenada

VP2GGG	**A**	**836,565**	**1333**	**215**
		(Opr. W5QBM)		

Mexico

XE1LLS	**7**	**41,072**	**141**	**68**

San Andres Is.

HKØBKX	**A**	**277,200**	**722**	**150**

Saint Pierre Is.

FPØBG	**14**	**9,163**	**65**	**49**
		(Opr. VE1AIH)		

Africa

Angola

CQ6LF	**A**	**1,936,938**	**2065**	**318**
XX6SM	"	251,870	525	178
CQ6OR	**28**	**424,815**	**653**	**223**
CR6OZ	**21**	**661,680**	**933**	**240**
XX6CC	"	464,175	698	225

Kenya

5Z4OY/A	**A**	**958,353**	**1270**	**257**
		(Opr. OH2BCP)		

Liberia

EL4D	14	19,894	136	49

Morocco

CN8BO	**A**	**1,907,880**	**1933**	**312**

Mozambique

CR7DB	**A**	**24,090**	**121**	**73**

Rhodesia

ZE1BL	A	6,120	51	40

Sao Thome Is.

CR5AJ	**14**	**52,503**	**167**	**111**

Asia

Bhutan

A51PN	**A**	**39,449**	**217**	**103**

India

VU2DK	**14**	**296,097**	**530**	**229**

Iran

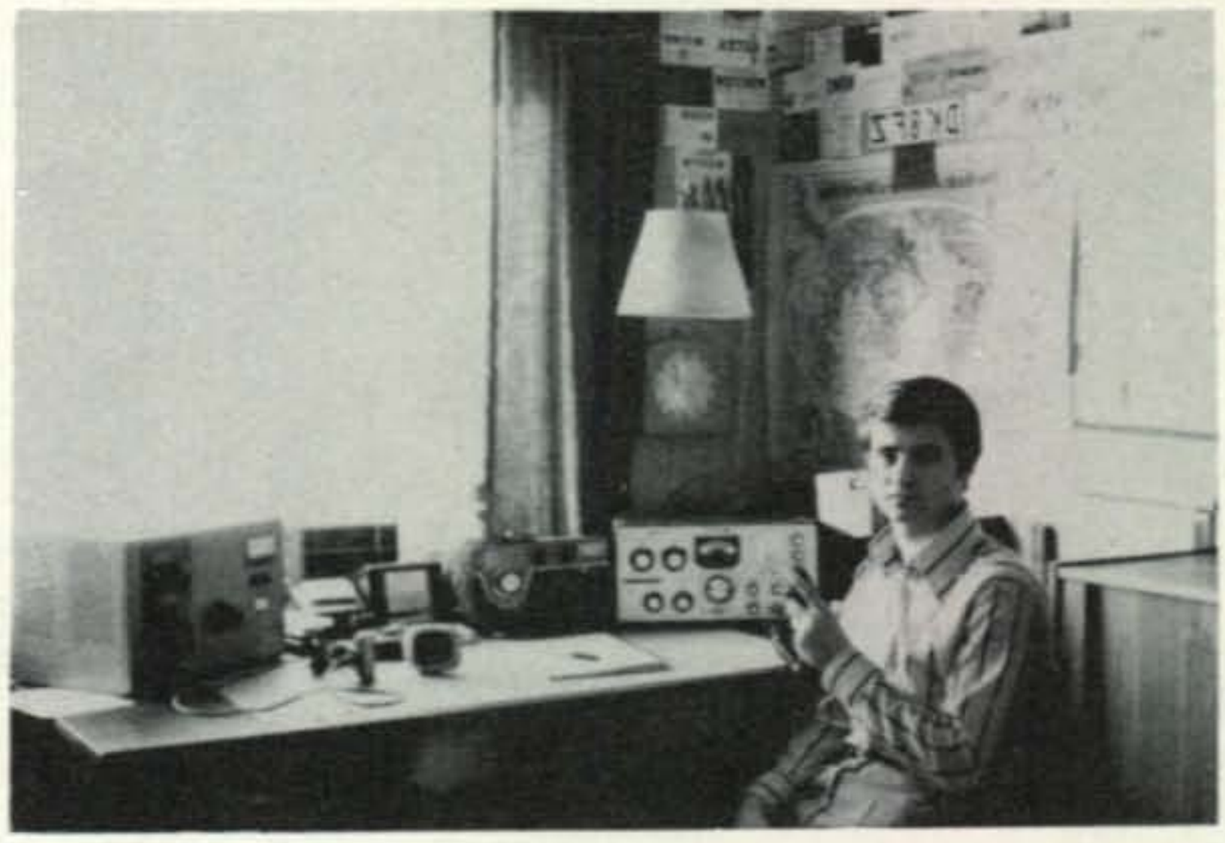
EP2NH	**A**	**67,465**	**281**	**131**

Israel

4X4QG	**28**	**41,736**	**152**	**94**
WA2KGY/4X	**21**	**135,675**	**410**	**135**

Japan

JA1OCA	**A**	**208,075**	**461**	**175**
JH1EIG	**A**	**135,470**	**334**	**155**
JR1FNZ	"	67,500	236	100
JA6CNL	"	63,308	216	133
JA2HUN	"	35,956	168	89
JA2INS	"	32,769	126	99
JA2MGE	"	18,796	113	74
JH1GTQ	"	11,277	73	63
JA1BUI	"	2,133	35	27
JA7HLO	"	1,595	34	29
JA7ARW	"	1,533	30	21
JH2IRN	"	884	28	26
JA2AIR	"	780	15	12
JA1EL	"	225	11	9
JA8IBU	"	154	9	7
JA1LDJ	"	84	6	6
JA3BBG	"	70	6	5
JR1INZ	**28**	**43,733**	**265**	**101**
JR1PZN	"	7,353	81	57
JH3GCN	"	5,192	73	44
JA1XZF	"	4,462	60	46
JA1RUJ	"	3,520	66	44
JA6BSM	**21**	**77,928**	**257**	**136**
JH2BIM	"	44,388	184	108
JH2MYN	"	37,125	180	99
JH2IRC	"	28,391	140	89
JA3ERG	"	24,920	161	89
JA3BUB	"	12,238	95	58
JA8WY	"	11,682	136	66
JA3CMD	"	10,472	86	56
JF1KXN	"	5,029	69	47
JH3FYW	"	4,033	67	37
JA6EFT	"	3,740	46	34
JR2BGE	"	2,436	37	28
JA3ELU	"	972	20	18
JA3YJQ	"	648	23	18
JA9AG	**14**	**235,119**	**504**	**181**
JA1PCY	"	45,594	180	102
JA7KTY	"	41,385	184	93
JA3IBU	"	37,184	170	83
JAØPZJ	"	15,678	107	67
JAØSC	"	14,006	117	47
JA8AIP	"	7,261	66	53
JA0AIE	"	6,825	67	39
JA1AAT	"	6,216	61	42
JA3VOV	"	4,480	51	40
JA5CEK/3	"	3,456	51	36
JA6YY	"	1,980	37	30
JA5COE	"	1,820	31	26



A young and eager contestant for a number of years, Egon, DK8FZ almost doubled his all-band single op score this year and took top honors for the Federal Republic of Germany. How about making it a million points in the next one?

This is Irene—the gal who for the past couple of years has managed to get the WPX winner certificate awards to you at the earliest possible date.

JH3BJN	"	512	16	16
JA7KM	"	114	8	6
JA2BAY	**7**	**82,626**	**211**	**94**
JA2BET	"	50,516	149	73
JA7HYS	"	1,470	19	15
JF1EEK	"	768	19	16
JA1SHY	"	640	13	10
JA3BCT	"	500	20	5
KA2PJ	**14**	**84,608**	**250**	**128**
KA7MS	"	16,320	105	68
Khmer Republic				
XU1DX	**A**	**514,609**	**1533**	**227**
		(Opr. K7CBZ)		
Lebanon				
OD5BA	**A**	**715,407**	**943**	**231**
OD5HJ	**14**	**8,154**	**116**	**54**
U.S.S.R.				
Asiatic				
UA9TS	**A**	**526,608**	**948**	**216**
UA9IF	**14**	**86,710**	**326**	**130**
UA9OS	"	18,113	158	59
UA9MT	"	12,597	70	57
UA9MQ	"	6,280	59	40
UA9UBH	**3.5**	**7,672**	**66**	**28**
4JØDI	**A**	**447,975**	**1300**	**165**
UAØCAH	"	55,380	731	60
UAØJBD	**28**	**5,304**	**119**	**34**
UAØAAL	**3.5**	**14,112**	**78**	**36**
Armenia				
UG6JJ	**14**	**44,844**	**165**	**101**
Azerbaijan				
UD6DHW	**14**	**59,360**	**205**	**106**
UD6DKM	"	7,245	59	45
Kazakh				
UL7FM	**A**	**387,748**	**792**	**212**
UL7DAF	"	262,095	694	173
UL7GAZ	"	244,968	700	177
UL7LAW	"	96,280	225	116
UL7YP	"	1,944	27	24
UL7YR	"	588	15	14
UL7TA	**28**	**3,930**	**111**	**30**
UL7JG	**14**	**237,413**	**502**	**191**
Tadjik				
UJ8JGJ	**14**	**509,787**	**840**	**237**
UJ8JJJ	**7**	**6,930**	**56**	**33**
Turkoman				
UH8BO	**14**	**80,693**	**225**	**137**
Uzbek				
RI8LAX	**28**	**1,560**	**51**	**24**
UI8LAG	**3.5**	**108,100**	**210**	**94**
Europe				
Austria				
DK5AD/OE2	**A**	**249,400**	**600**	**200**
Balearic Is.				
EA6CK	**A**	**113,457**	**473**	**177**
Bulgaria				
LZ2RF	**A**	**152,342**	**449**	**211**
LZ1MH	"	124,998	500	166
LZ2EE	"	12,730	86	67
LZ1QH	**21**	**17,280**	**127**	**54**
LZ2KSB	14	1,960	50	35
LZ2JF	**3.5**	**114,686**	**361**	**143**
Czechoslovakia				
OK3YCE	**A**	**323,520**	**637**	**240**
OK3EA	"	190,347	462	201
OK1KZ	"	72,485	326	133
OK1AGN	"	71,336	254	148
OK1AHV	"	52,540	237	148
OK1TA	"	28,987	132	101
OK1KVK	"	26,772	150	92
OK2BEF	"	13,760	107	64
OK2BKI	"	13,580	120	70
OK2QX	"	13,056	107	64
OK2PEQ	"	7,020	72	60
OK1WT	"	6,400	69	50
OK2SMO	"	1,922	34	31
OK1ATE	**14**	**120,276**	**379**	**156**
OK1MPP	"	86,652	258	174
OK3LU	"	53,170	227	130
OK1AVU	"	45,320	204	103
OK1AJN	"	17,775	167	75
OK2BBJ	"	16,985	155	79
OK1DVK	"	4,560	48	48
OK2PBG	"	2,916	65	36
OK1MP	**7**	**27,492**	**141**	**87**
OK2KR	"	22,100	131	85
OK2BNK	"	450	17	15
OK2BIQ	**3.5**	**113,778**	**400**	**147**
OK1AHI	"	68,094	295	117
OK2BKH	"	51,450	234	105
OK1EP	"	21,450	152	75
OK1FBV	"	16,724	120	74
OK1AAE	"	9,912	83	59
OK3TBG	"	5,590	71	43
OK1UY	"	5,208	66	42
OK2PEL	"	2,772	45	33
OK1MJL	"	756	23	18
OK3ARP	"	392	14	14
Denmark				
OZ6XR	**A**	**42,552**	**212**	**108**
OZ1XO	"	5,356	70	52
OZ4HW	"	4,773	82	37
OZ6PI	**14**	**101,680**	**385**	**164**
OZ8KU	**7**	**4,452**	**56**	**42**
OZ8XZ	"	1,856	38	29
OZ5EV	**3.5**	**122,008**	**400**	**151**
OZ9XM	"	1,000	25	20
England				
G3HTA	**A**	**306,138**	**622**	**222**
G4AYA	"	87,291	369	159
G4CLA	"	66,220	324	140
G3YBH	"	60,047	215	149
G8VF	"	46,482	248	122
G2AJB	"	23,280	148	97
G3NRQ	"	1,239	44	21
G4AYL/A	**14**	**397,544**	**776**	**229**
G4CKL	"	54,806	262	134
G4ACQ	**7**	**55,454**	**217**	**119**
G3JUL	**3.5**	**33,578**	**171**	**103**
Finland				
OH3YI	**A**	**537,285**	**924**	**301**
OH1IJ	"	313,470	682	243
OH1LW	"	268,424	674	232
OH5YF	"	8,832	70	69
OH2BMG	"	4,136	64	47
OH7TO	"	3,913	66	43
OH7NW	"	2,400	53	32
OH5RZ	"	2,072	42	37
OH2BO	"	1,846	34	26
OH8OR	"	147	7	7
OH3WN	**21**	**1,700**	**26**	**25**
OH3WW	**21**	**1,700**	**26**	**25**
OH1UR	"	60	6	5
OH1VR	**14**	**299,172**	**835**	**233**
OH1IG	**"**	**38,220**	**344**	**105**
OH6MM	"	36,685	287	115
OH4SM	"	15,552	162	81
OH7SC	"	7,006	77	62
OH2EQ	"	6,580	84	47
OH7PB	"	6,096	70	48
OH1PG	"	264	16	12
OH7TV	"	105	7	7
OH2KI	**7**	**259,440**	**456**	**188**
OH6ZH	"	51,304	208	106
OH1XX	**3.5**	**170,624**	**518**	**172**
OH2DN	"	16,660	120	70
France				
F9MD	**A**	**293,480**	**535**	**232**
F6AXO	"	58,362	247	137
F6BJA	"	37,210	153	122
F3IJ	"	18,252	119	78
F2QQ	**14**	**449,320**	**825**	**235**
Germany (East)				
DM2DUK	**A**	**762,128**	**1200**	**304**
DM6TAH	"	60,420	300	106
DM4YEL	"	49,184	229	116
DM2AJH	"	38,266	180	106
DM3XLB	"	14,280	109	68
DM2BPB	"	9,676	101	59
DM2DGO	**14**	**13,952**	**94**	**64**
DM4GM	"	121	11	11
DM3BB	"	120	8	6
DM3CF	"	60	6	6
DM2BOO	7	60	6	5
DM5IG	**3.5**	**9,130**	**83**	**55**
DM3WB	"	242	11	11
Germany West				
DK8FZ	**A**	**822,617**	**1113**	**337**
DK5GX	"	24,196	138	92
DL6OX	"	13,600	97	68
DL7AN	"	12,084	106	76
DJ7HL	"	1,632	40	34
DL1YA	"	230	10	10
DL1ED	**28**	**2,673**	**36**	**27**
DL2JO	**21**	**3,780**	**53**	**35**
DK1FW	**14**	**510,402**	**808**	**257**
DJØEW	"	193,888	545	146
DK7ZJ	"	10,980	142	61
DJØUJ	**7**	**96,944**	**330**	**146**
DL8PC	**3.5**	**208,278**	**605**	**189**
DK4OO	"	104,976	342	162
DK4EX	"	9,372	84	71
DK5OL	"	6,834	76	51
DA1CT	**14**	**87,032**	**292**	**172**
DA1YH	**3.5**	**5,428**	**60**	**46**
Greece				
SVØWGG	**AA**	**461,805**	**1262**	**255**
Hungary				
HA5KFN	**A**	**29,205**	**167**	**99**
HA5CI	"	20,210	126	94
HA7LF	**14**	**258,930**	**663**	**210**
HA5DG	"	7,676	76	76
HA7SQ	"	4,928	73	44
HA7PQ	**7**	**16,330**	**119**	**71**
HA4KXC	**3.5**	**143,040**	**517**	**160**
HA4XX	"	30,616	179	89
Iceland				
TF3SB	**A**	**11,534**	**129**	**73**
Italy				
I3PRK	**A**	**665,577**	**933**	**301**
I1ANP	"	183,141	611	189
I6VDB	"	85,284	368	138
I4CSP	"	75,692	279	149
I2AT	**28**	**5,640**	**53**	**40**
I4BNR	**21**	**90,640**	**328**	**103**
I8KBT	"	67,056	246	132
I5FCK	**14**	**339,416**	**719**	**203**
I3GNX	"	66,062	302	134
I5PLS	"	62,906	309	142
I5XRR	"	44,195	180	127
I4BMJ	**7**	**180,958**	**497**	**173**
I3BBZ	"	81,388	292	126
I3MAU	**3.5**	**215,940**	**569**	**177**
Luxembourg				
LX1RK	**A**	**14,378**	**116**	**79**
Netherlands				
PAØHBO	**A**	**605,730**	**919**	**305**
PAØVB	"	2,278	44	34
PAØYN	"	2,133	52	27
PAØLVK	**14**	**5,040**	**58**	**45**
PAØTO	"	912	34	24
Norway				
LA5QK	**A**	**76,437**	**308**	**149**
LAØAR	"	54,929	315	133
LA5JS	"	42,408	229	114
LA6HL	"	4,082	53	26
LA3WQ	21	128	10	8
LA3BG	**14**	**89,125**	**362**	**155**
LA3UQ	"	27,072	203	96
LA5KO	"	6,324	64	51
LH2A	"	162	9	9
Poland				
SP9AI	**A**	**158,260**	**477**	**193**
SP5BB	"	113,150	385	155
SP5XM	"	60,382	262	133
SP9EHP	"	40,837	220	97
SP9ZD	"	33,158	158	118
SP5KGT	"	32,476	161	92
SP2BBD	"	25,414	148	97
SP2GNB	"	16,704	140	87
SP7ETG	"	15,366	115	78
SP9YP	"	12,654	109	74
SP5ZBL	"	9,828	91	63
SP3GEM	"	7,227	113	33
SP6AGK	"	4,687	62	43
SP6AEG	"	2,079	34	27
SP9PT	"	1,890	31	30
SP9EHW	"	1,890	30	27
SP3DOI	**21**	**4,407**	**42**	**39**
SP8AWL	"	1,575	28	21
SP4CLX	**14**	**73,414**	**356**	**142**
SP7ASZ	"	25,753	157	91
SP9ABU	"	24,990	176	98
SP9ADU	"	14,700	115	75
SP5AMX	"	2,465	50	29
SP8AOV	"	1,000	28	20
SP3CTC	"	260	10	10
SP6ECA	"	160	14	10
SP6TQ	**7**	**47,586**	**215**	**103**
SP5DZI	**3.5**	**98,914**	**339**	**137**
SP3BLG	"	75,504	307	121
SP2CMB	"	27,468	185	84
SP6AGD	"	24,734	151	83
SP6AFO	"	16,614	133	71
SP9PEW	"	11,748	104	66
SP9ETK	"	1,716	34	26
SP9DH	"	1,056	28	24
SP9PBZ	"	4	2	2
Portugal				
CA1MZ	**A**	**4,354**	**45**	**39**
Romania				
YO7DL	**A**	**87,745**	**418**	**161**
YO6KAF	"	64,170	251	138
		(Opr. YO6AWR)		
YO3AC	"	22,780	106	85
YO7AWN	"	19,832	134	74
YO3JW	**3.5**	**105,080**	**356**	**142**
YO7AQE	"	480	21	12
Scotland				
GM5BCV	**A**	**191,967**	**634**	**183**
Spain				
EA5HM	**A**	**68,391**	**350**	**149**
EA2JD	**14**	**88,616**	**389**	**152**
Sweden				
SM5BNX	**A**	**31,860**	**209**	**108**
SM5RE	"	19,264	152	86
SM7AIO	"	18,382	101	101
SM7TV	"	13,260	116	68
SMØCGO	"	11,682	95	66
SM5ARL	"	7,452	85	69
SK1AQ	"	4,128	48	43
		(Opr. SM1CXE)		
SM2EQT	"	3,081	50	39
SM7ECX/M	"	1,248	26	24
SM4AZD	"	1,170	28	26
SM1CNS	**14**	**455,445**	**822**	**261**
SM7DMN	"	31,200	240	104
SMØATN	"	9,864	73	72
SMØBPZ	"	5,355	61	51
SM7CRW	**3.5**	**36,248**	**201**	**92**
Switzerland				
HB9AWM	**A**	**200,070**	**495**	**190**
HB9UD	"	3,135	40	33
Vatican				
HV3SJ	**A**	**60,478**	**325**	**139**

OH2MM, Vilho, along with Marty, OH2BH; Pierre, OD5HC; and Aris, SV1GA stirred up a beehive of activity from Cyprus as SV1GA/5B4. Vilho's photo was taken at Joe's, OD5BA on a stopover from Cyprus. Bet there was a lot of WPX contest rag-chewing?

Wales

GW4AES	14	62,424	364	136
GW4BLE	7	114,608	312	152

Yugoslavia

YU1OCV	A	144,375	457	165
YU2RAM	"	42,368	196	128
YU2RKC	28	12,320	79	55
YU2ROZ	21	72,220	239	115
YU2CDS	14	845,568	1340	288
YU3TKT	"	10,010	126	65
YU5XDX	"	4,200	74	50
YU2OB	7	72,570	266	123
YU1AJE	"	1,782	40	27
YU4EBL	3.5	244,818	590	201
		(Opr. YU4VFF)		
YU1DVW	"	49,220	276	107
YU1AGU	"	14,490	114	63

U.S.S.R.

European

UW6MT	A	368,461	778	229
UV3DN	"	155,340	513	180
UA3ST	"	137,175	471	177
UA4SR	"	56,140	236	140
UV3TQ	"	26,132	166	94
UA3DAO	"	23,352	150	84
UA3XP	"	23,220	147	86
UA3WZ	"	21,204	151	76
UA6LWI	"	20,111	151	91
UA6HAC	"	3,706	47	34
UA1WAA	"	2,030	41	35
UA6JAD	28	714	17	14
UA6HYL	"	216	9	8
UW6CV	21	66,712	316	124
UA4CZ	"	65,201	288	113
UA6BV	"	27,621	155	99
UW3RR	"	5,916	98	51
UW6CW	"	1,272	31	24
UW4NP	14	266,500	660	205
UZ3TC	"	160,362	611	177
UA3GM	"	92,253	336	161
UW3CX	"	71,910	290	141
UW6LC	"	70,328	331	149
UA1MU	"	25,654	142	101
UA1GBE	"	4,800	74	50
UA6HY	"	3,220	57	46
UA3IE	"	450	23	18
UA3QAQ	3.5	48,672	238	104
UA3ERD	"	46,848	218	96
UA3EAT	"	15,080	112	58
UA4UAZ	"	13,356	112	53
UA4YAW	"	11,792	90	44
UA1ALN	"	9,633	114	57
UA6HBU	"	3,392	54	32

Kaliningrad

UA2EC	A	155,040	407	170

Latvia

UQ2DV	A	98,100	348	150
UQ2MU	"	65,024	345	128
UQ2CR	"	52,210	246	115
UQ2AS	3.5	37,856	197	91
UQ2GBU	"	37,410	207	87
UQ2GCN	"	21,754	141	73

Lithuania

UP2OU	A	373,302	817	223
UP2BAS	21	968	24	22
UP2FA	3.5	20,700	143	69

Moldavia

UO5BZ	A	33,712	180	112

Ukraine

UT5RT	A	596,882	1172	286
UB5LU	"	32,996	217	113
UY5ZT	"	1,302	32	31
UB5VAZ	28	1,679	28	23
RB5VAC	"	216	9	8
RB5ABX	"	75	6	5
UY5OO	21	65,835	271	99
UB5AAF	"	6,204	59	47
UB5CI	14	219,960	667	234
UB5OD	"	38,985	237	113
UB5XY	7	2,880	50	30
UB5WF	3.5	88,844	317	133
UB5EDU	"	77,736	271	123
UB5QCQ	"	55,414	236	103
UB5VAL	"	42,780	217	93
UB5VAN	"	29,928	170	86
UB5QBG	"	10,560	101	44

White Russia

UC2WP	A	38,232	288	108
UC2BF	"	1,825	28	25
UK2AAB	7	11,600	106	58

Oceania

Australia

VK1AOP	A	111,006	335	126
VK2OW	A	8,358	71	42
VK4VU	A	274,247	642	139
VK4FH	"	182,932	536	116
VK4AK	"	21,375	110	75
VK5NO	A	351,770	838	145
VK5MF	"	74,980	283	92
VK2XT	21	31,977	323	33
VK3SM	21	23,779	193	43
VK4PJ	"	714	19	14
VK2APK	14	229,824	479	171
VK6LK	14	99,975	281	129

Guam

KG6JAR	14	32,214	200	59

Hawaii

KH6RS	A	1,235,208	2466	156
		(Opr. K2SIL)		
KH6IJ	21	270,060	1291	70
KH6GMP	14	477,246	1072	154

Marshall Is.

KX6LM	A	126,290	600	73

New Zealand

ZL1BKX	A	183,352	345	164
ZL1AMM	"	68,355	225	105
ZL1AAS	14	90,060	272	114
ZL4BO	7	58,824	152	76

Samoa (American)

KS6DH	A	1,046,446	1758	193

Western Samoa

5W1AN	14	65,764	277	82

South America

Argentina

LU5HFI	A	1,780,600	1885	307
		(Opr. F5QQ)		
LU8AJG	A	1,072,500	1369	275
LU2DEK	21	20,097	114	63

Bolivia

CP3BY/1	A	38,364	162	92

Brazil

PS4KL	A	513,280	663	256
PS7ARM	"	352,429	601	199
PS8JO	"	297,666	521	207
PS6AM	"	280,596	501	201
PS2JB	"	242,332	463	188
PY2AQG	"	29,646	128	81
PY3CKL	"	26,800	143	67
PT1AA	"	24,300	117	81
		(Opr. PT2GBZ)		
PY1CHP	"	5,375	46	43
PS4BTK	"	512	16	16
PY1BOL	28	11,564	74	59
PY1BDU	21	148,035	364	139
PY1DBE	14	154,305	397	135
PS1CCK	"	825	31	25
PY2ELZ	7	19,910	70	55
PY3CGP	"	4,482	38	27
PS2FIZ	3.5	140	9	7
PY2FOT	"	112	7	7

Chile

CE6EZ	28	266,668	575	163

Colombia

WA6TLJ/HK6	A	47,286	153	74

Ecuador

HC1WW	A	7,434	62	42

Peru

OAN4ANR	7	4,480	40	32

Uruguay

CX1JM	A	1,216,212	1534	258
CX7BQ	"	124,950	313	147

Venezuela

YV6AW	A	1,673,660	1744	268
YV1TO	"	533,168	814	188
YV3CL	"	141,984	300	153
YV4YC	28	73,260	296	90
YV4OW/7	7	132,210	201	117
YV4TI	3.5	176,064	316	96

MULTI-OPERATOR

Single Transmitter

United States

WA6GLD	137,250	340	122
WØEEE	109,585	341	155
K3IVO	94,710	247	154
WB8IAY	60,588	212	132
WM5BIL	39,550	604	89
W6VPZ	28,137	149	83
WAØCGV	1,914	38	33

North America

VP5CW	2,000,985	2444	285
VA6WDX	133,945	576	89

Africa

CR4BC	1,262,533	1332	281

Asia

4X4NJ	2,845,905	2506	339
9M2CX	449,838	1628	201
JH1YDT	166,980	390	165
JA6YTU	151,060	457	166
JA1YFG	59,267	216	97

Europe

YU1BCD	1,613,920	1889	352
I6FLD	1,377,720	1694	356
G4DAA	1,063,535	1563	305
SP5PWK	952,380	1217	333
HG8U	767,529	1392	279
DJØEK	681,884	1050	294
HA9KOB	679,481	1291	277
G3RCV	580,350	1006	265
DK4OV	576,160	919	277
SK6BA	518,940	832	270
SP6PZB	502,000	990	251
EI1AA	480,636	1065	234
YU2CBM	429,408	901	252
OH3AM	421,751	1003	253
DKØSD	394,389	758	243
ZB2WPX	383,280	1019	240
I3BKT	370,403	720	223
HA5AIR	338,549	701	233
LZ2KPD	311,831	906	221
SP9KRT	280,704	887	192
HA5KKB	262,353	652	217
HA2KRL	258,543	650	207
G4BUE	228,437	539	209
OH8RC	209,979	489	189
HA7KLG	201,798	487	202
OH5WJ	165,615	545	183
LA1K	159,216	649	186
HA5KKW	147,028	480	178
OK1KPU	141,432	460	166
SP3KGJ	136,950	446	165
HA7KLF	134,640	416	180
HA5KAS	124,041	394	173
HA7KLC	116,154	426	162
OH4RH	112,391	401	167
PI1ARS	96,924	332	164
HA2KMR	84,960	329	144
HA5KMB	83,475	301	159
OK3KGI	78,120	360	126
SP9ZAF	74,746	313	133
OK3KTR	66,640	277	136
OK1KUR	55,876	263	122
YU2CDO	35,350	268	101
SK4EN	33,000	180	100
SP6KDA	30,749	173	97
OK1KUO	18,326	126	77
OK2KWL	17,608	121	71
SP5KOH	11,904	100	62
SP3ZAH	10,521	87	63
OK3KAP	2,592	43	36

Oceania

ZL2HV	54,560	228	88

South America

PJ9JR	4,543,618	3631	347
PY2CAB	3,647,904	3101	416
PS7BDX	2,519,700	2335	370
PS7NS	883,500	1168	250

U.S.S.R. Club Stations

Asia

UK9ABA	2,530,098	1980	367
UK6APA	2,094,666	1908	371
UK9CAE	908,295	1120	285
UKØAAB	590,180	1246	230
UK9OAZ	428,358	1060	217
UK9FFR	327,128	549	206
UK6FAF	276,344	489	169
UK6GAA	207,701	405	169
UK9OBI	108,772	323	142
UKØCAX	100,470	779	85
UKØSAL	80,400	358	120
UK9OAW	56,462	241	109
UK7PAL	17,006	138	58

Europe

UK2GKW	1,391,712	1848	336
UK6LEZ	1,194,165	1557	315
UK5IAZ	1,037,162	1694	322
UK3AAC	790,560	1383	305
UK3SAB	611,000	1277	235
UK3DBG	424,964	942	262
UK3DAA	418,396	954	257
UK2BAE	375,375	1000	231
U5ARTEK	335,160	797	190
UK4WAB	335,025	744	225
UK2BAF	315,545	735	223
UK4WAC	313,124	754	212
UK3ARO	298,584	692	234
UK5MAG	285,824	750	203
UK5EAO	253,344	708	208

[Continued on page 70]

Announcing The QRPp Transmitter Design Contest

BY ADRIAN WEISS,* K8EEG

THERE can be no doubt about it—operating with very low power offers something that can't be found in other facets of amateur radio. The thousands of converts to the QRPp "alternate life style" attest to this fact. However, both newcomer and veteran alike face a common difficulty when the time comes for upgrading their stations.

Most of us start out with a simple, single-band, crystal controlled transmitter used in conjunction with the sophisticated all-band station receiver and antenna system. Once one gets the hang of QRPp operation and the attendant skills, such a transmitter becomes a real obstacle. To make the best use of our knowledge of propagation, a band switching capability is essential, as is the flexibility of v.f.o. control. Unfortunately, the only commercially produced QRPp rig providing this degree of flexibility is the superb Argonaut. But many QRPp'ers don't see any sense in laying out the cash for an extra receiver just to get a transmitter. Home-brewers are no better off. With one exception[1] which is outdated, I know of no published design for an all-band, v.f.o. controlled QRPp transmitter. What the QRPp movement needs most desperately at this stage, then, is a flexible transmitter that can serve adequately with the all-band receiver and antenna system.

CQ's policy of encouraging QRPp continues in its present sponsorship of this "QRPp Transmitter Design Contest." The contest is intended to produce the badly needed design for an all-band, v.f.o. QRPp transmitter.

By offering instant fame and recognition (publication of the winning design—and perhaps the runner-ups), riches (payment for published articles), tangible rewards (a TenTec 215 receiver for the winner, a Curtis Electro Devices 8043-1 "Keyer on a chip" for each of two runners up, and satisfaction (the knowledge that hundreds and perhaps thousands will be duplicating your design), we at *CQ* hope that we can motivate many of you to try your hand in the contest. At the very worst, you will end up with a unique QRPp rig that you can use with pride and satisfaction.

I want to emphasize the point that this is not intended to be a contest for graduate engineers —although they can compete. What we are looking for is a good, all-around design that works—we are *not* looking for an original work of genius, although that certainly would be nice. So, design from scratch, or pick a circuit from here, another from there, put it all together, and if it works well, it may win! The following comments are intended as suggested specifications for the winning design.

V.F.O.

The v.f.o. should permit coverage of at least 100 kHz of the 80, 40, 20, and 15 meter bands; 10 meters may be included if desired. Any v.f.o. system is acceptable—separate tanks for each band, a frequency multiplication scheme, heterodyne scheme, or whatever—so long as a reasonable degree of electrical, thermal and mechanical stability is inherent in the design. In addition, the v.f.o. should be adequately isolated from later r.f. stages to avoid possible r.f. feedback and excessive "pulling" during key-down periods.

R.F. Stages

The r.f. section should feature coverage of the four bands mentioned above, and be capable of at least four watts r.f. output power. Either discrete or broadband tuning of the r.f. stages is acceptable, so long as harmonics are down 30 dB from fundamental. Interstage and output circuits should be designed so that spurious tuned spots will not occur within the range of the components specified.

The transmitter should be operable with B+ supplies of 12-13.6 volts. We strongly recommend that a modern "ballasted emitter" or mismatch protected" r.f. device be used in the final amplifier. Types such as the 2N5590, 2N5995 are recommended, and devices specifically intended for broadband service would be wise choices if the designer chooses to take the broadband route. Keying of the B+ except through a properly designed solid state switch should be avoided. Reliability is an important factor. If it takes an extra r.f. stage to guarantee the required output power, use the extra stage rather than depending upon very critical peaking of a single stage.

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*213 Forest Ave., Vermillion, SD 57069

[1]Weiss, A., K8EEG, "A Multiband FET V.F.O. QRPp Transmitter," *ham radio*, (July, 1972), p. 39. The TenTec r.f. module is no longer in production.

General

One key criteria to be applied in judging submitted designs is the ease of duplication. This doesn't mean that the transmitter must be simple. Even a complex circuit can be duplicated by a beginner if the designer makes the rationale of the circuit clear, uses readily available parts, and provides a clear p.c. board design if that form of construction is chosen. Miniaturization is *not* one of our criteria.

Submitted designs may be as complex or as simple as desired. The winner will be chosen entirely on the basis of the design and performance of the c.w. r.f. section of the entry. For example, an entry may be a complete s.s.b./c.w. transmitter with s.w.r./wattmeter, keyer, sidetone, etc.—we'll judge only the c.w. r.f. performance of the design.

While attractive cabinetry can obviously be a source of pride to a designer, we will not take housing into consideration in selecting the winner.

If it is necessary to use exotic parts, a source for such parts should be indicated.

Entries

Deadline for entries is June 1, 1975. The initial entry should include the circuit itself, parts specified on the schematic, or on a separate sheet with a listing of sources for any unusual parts. The above must be accompanied by a supporting explanation of the rationale of the circuit, preferably with a block diagram, with commentary on any unusual features of the circuit. These notes are only intended for the assistance of the judges. A snapshot will be sufficient evidence of the existence of the unit, for preliminary entries.

The finalists will be selected from these initial entries. We reserve the right to request and test actual working models of the finalist designs in order to choose the winner.

Ten finalists will be selected from the initial entries by a screening panel composed of *CQ* staff. Selection of the winner and two runners up will be made by a panel consisting of: Wilfred M. Scherer, W2AEF, *CQ* Technical Consultant; Dan Tomcik, K4HYF, V.P. TenTec, and Jack Birchfield, K4DCD, Executive V.P. TenTec; and Bob Fernau, W8NDG of Heathkit, design engineer of the HW-7. Decisions of the panel will be reported in the QRPp column in *CQ*.

So gang, there it is! We're confident that many of you will take up the gauntlet in the service of QRPp'ers everywhere and that your efforts will result in a reliable, flexible QRPp transmitter that will be as important to the QRPp movement in years to come as the old Heath AT-1 was to a generation of Novices in the 'fifties. So, dig into the books and come up with a winner! We'll all be winners in this one! ■

CQ to Change Abbreviation Style

In response to reader requests and the pressure of the technical writing field, *CQ* will adopt a number of minor changes in its basic style of technical abbreviation beginning with the January 1975 issue.

The following units, abbreviations and prefixes will be used in *CQ*. In many cases the abbreviations are identical to those used all along, but a few significant changes have been made to eliminate ambiguities in prefixes. While not all the unit abbreviations coincide with the recommendations of the International Electrotechnical Commission, the American Standards Association or the IEEE, we feel that our readers will find them to be unambiguous and unconfusing. The abbreviations represent the most convenient and stylistically sound approach for our publications.

Units		Prefixes	
Ampere	- a	M = mega	= 10^6
Decibel	- db	k = kilo	= 10^3
Farad	- f	m = milli	= 10^{-3}
Henry	- h	μ = micro	= 10^{-6}
Hertz	- Hz	n = nano*	= 10^{-9}
Meter	- m	p = pico	= 10^{-12}
Ohm	- ohm or Ω		
Volt	- v		
Watt	- w		

Using these basic elements, the most common units will become: MHz = megahertz, Mw = megawatt, kw = kilowatt, kv = kilovolt, kHz = kilohertz, ma =milliampere, mh = millihenry, mm = millimeter, mv = millivolt, mw = milliwatt, μa = microampere, μf = microfarad, μh = microhenry, μv = microvolt, μw = microwatt, pf = picofarad (.001 mf).

* Not normally used except in relation to seconds.

COP's COLUMN

BY COPTHORNE MACDONALD,*
WØORX

On-The-Air "Futures Hamfest"

What do you have planned for the weekend of March 8-9? How about taking part in the very first on-the-air "Futures Hamfest" which will be held that weekend? Suggested originally by Ron Wilbur, K6ZEZ, the idea of sharing a weekend of fun and enlightenment on the ham bands has excited a number of us. There will be some talks on the ham gear of the future, of course, and certificates for those stations who work to help make the weekend happen. But there will also be sessions on Economics, Alternative Energy Sources, Women's Issues, Education, the Environment Decentralized Living, Ham Radio's Future, and other concerns we share. One of the basic ideas is to open up our shacks and share this ham radio weekend with others. Some sessions will use s.s.b.-only, and some RTTY, but many of the sessions will utilize SSTV to permit speakers to illustrate their talks. This will be a real opportunity for SSTVers to declare a weekend "open house" to the local ham club members, and maybe even to the whole town as well. It will be perfect chance to show off what SSTV can d and to demonstrate a serious use of ham radi (Don't forget to invite the local newspaper an TV photographers too.) There will be som *very* knowledgeable speakers, with question an answer sessions in most cases so that you ar I can ask those questions which have been bu ging us. Look for more details in this colum and elsewhere as the time draws nearer, b right now volunteers are needed to work c preparations. Stations that get out well a needed for Moderator duty, and to host gue speakers (either in the shack or via pho patch). Slow-scanners willing to convert spea er's slides and photos into SSTV tapes a needed too. Finally, if you know one or mo "doing" people working toward a better futu in some field or other, see if he or she wo volunteer as a speaker. The heroic Chairm and coordinator of this effort is Randy Brin WA7BKR. If you'd like to lend a hand, co tact him on 3898 kHz Sunday, Tuesday, a Thursday nights at 8 P.M. PST, or Sunday aft noons on 14253 at Noon PST. (If ham rad fails you, his address is RFD 2, Box 301- Port Orchard, Washington 98366).

*P.O. Box 483, Rochester, MN 55901.

R.F. Pickup On Cables

In last month's column we looked at w "r.f. in the shack" causes problems, and so of the ways to minimize the difficulties grounding units together and filtering the a line. R.f. can also enter a unit by way of interconnecting cables. Speaker wires, aud patch cables, camera cables, mike cables, f. or TV antenna lead-in wires, and even hea phones can be culprits. Using shielded ca having an overall braided (not spiral-wrappe shield is a good idea, and is often sufficient the units at each end of the cable are w shielded. With unshielded cables (and ev shielded cables if high r.f. currents flow in t braid) the r.f. picked up must be filtered o Sometimes bypassing each lead to the chas will suffice. Sometimes an *R-C* or *L-C* filter each lead is required. Table I gives the re tance of some common *L*'s and *C*'s at varic frequencies. The basic idea is to put some

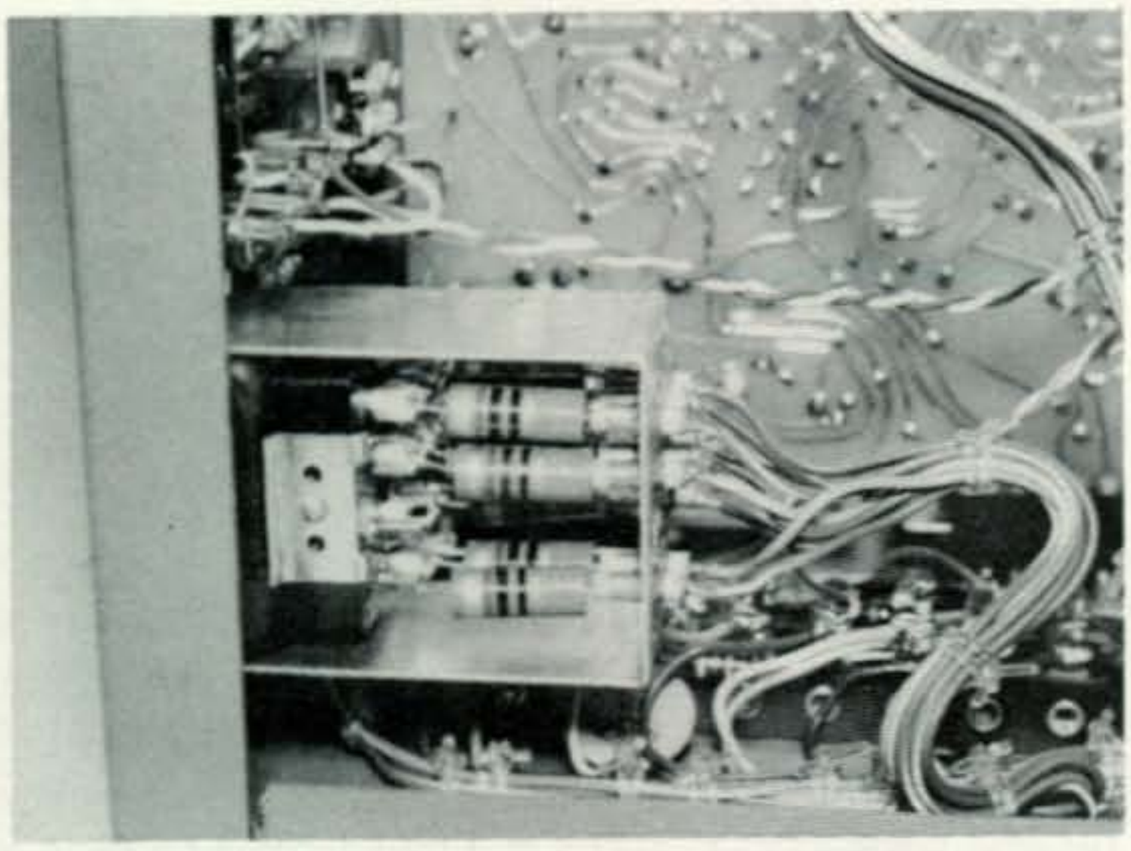


Fig. 1—10 μh inductors and .001 mf feedthrough capacitors in this Robot camera provide RFI filtering of each wire in the camera cable.

Absolute Value of Reactance in Ohms				
Part Value	3 kHz	20 kHz	3.5 mHz	30 m
.01 mf	5.3K	800	4.5	<1
.001 mf	53K	8K	45	5.3
100 pf	530K	80K	450	53
10 μh	<1	1.3	220	1.9I
100 μh	1.9	13	2.2K	*

*Depends upon distributed winding capacita

Table I—Reactance of some common RFI fi components at several frequencies of interest

ductive reactance or resistance in series with the lead entering the unit before bypassing it to chassis ground with a capacitor. Figure 1 shows the scheme that Robot uses in their SSTV camera. In series with each lead entering the camera is a 10 μh inductor followed by a .001 mf feedthrough capacitor to ground. In high impedance circuits, series resistors can be used instead of inductors. Table I plus common sense can help to pick suitable values in different situations. For example, in filtering a power supply lead, select an inductor with a d.c. resistance low enough to give an acceptably low voltage drop, yet presenting a reasonably high reactance at r.f. frequencies. Good values of bypass capacitance for power leads are .01 and .02 mf. When filtering audio or slow-scan video leads you must consider both the frequency response you want to preserve, and the impedance level. At the maximum audio frequency desired, the series impedance should be low, and the capacitive reactance high, compared to the parallel combination of source and load resistance. Thus, for a 600 ohm audio line carrying speech or SSTV, a .01 or .02 mf bypass would be fine. The "auxiliary" input of a Hi-Fi amplifier may involve an impedance to ground of 10K or so. Therefore, if the full 20 kHz frequency response is desired, the shunt *C* should not exceed 330 or 470 pf. A 330 pf capacitor is not an ideal bypass in the 3 to 30 mHz range. To optimize the filtering you might want to select a series choke that is self-resonant near the highest frequency at which your rig causes RFI. A second possibility in a case like this would be to use a multi-stage filter as shown in fig. 2(D), or settle for some reduction of audio frequency response.

A caution regarding inductors: they don't act like inductors above their self-resonant frequencies, so going to high values of inductance can actually *reduce* attenuation at high frequencies. A choke which is effective throughout the v.h.f. and u.h.f. range can be made by slipping two or three ferrite beads on a piece of bare wire. Type 43-101 ferrite beads are suitable, and are available from Amidon Associates, 12033 Otsego Street, North Hollywood, Calif. 91607.

Coax antenna lead-ins do not generally bring much stray r.f. into a ham receiver because the shield is grounded to the chassis, and the input stage is generally very close to the input connector. TV and f.m. receivers are usually designed for a balanced 300 ohm input and do have problems. The best approach is installing a good high pass filter such as the R. L. Drake TV-300HP-R.

Last Ditch Efforts

Sometimes, even if the a.c. line has been filtered as described in last month's column, and interconnecting leads coming into the unit

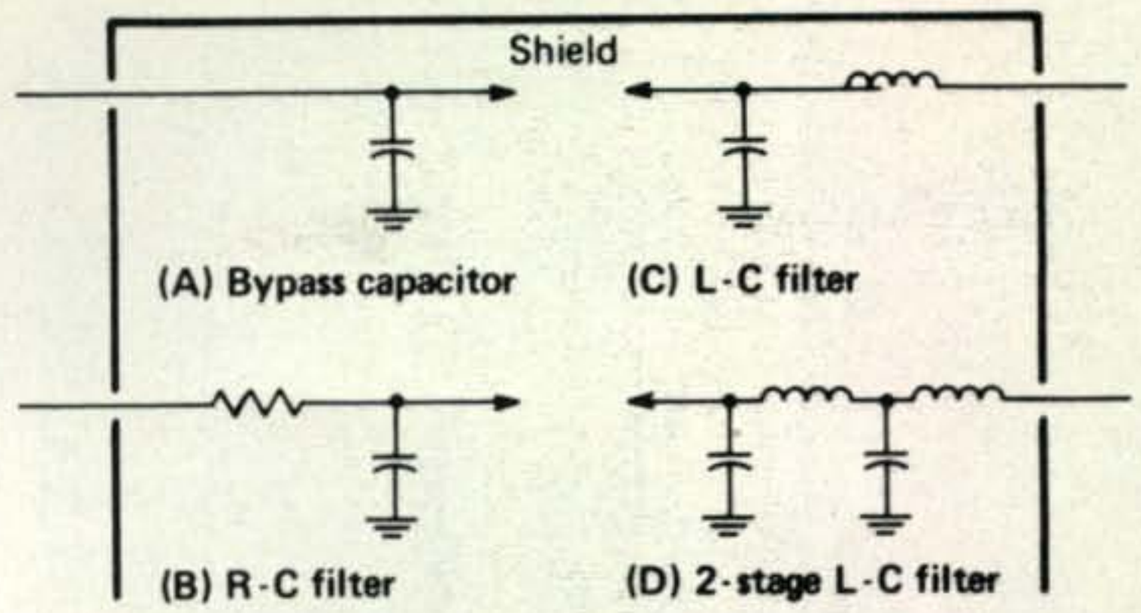


Fig. 2—Four common ways of filtering interconnecting cable leads for RFI.

have been filtered as described above, the interference will still persist. If this happens in a well-shielded unit it generally means that the filtering of the a.c. line and other leads going into the unit is still not adequate. If the unit is a tape recorder, stereo amp, or TV set in a wood or plastic cabinet, the remaining interference is probably related to the lack of shielding.

There are two ways to attack the problem. The first is to shield the cabinet by carefully gluing aluminum foil to the inside cabinet walls. Do not cover ventilation holes with foil, and if the unit generates a lot of heat, spray the foil with black paint so there is no shiny surface to reflect the heat back toward the chassis. Make sure that the chassis makes good electrical contact with bare foil in several places.

Sometimes shielding is not practical at all. In other situations it is not possible to shield a unit completely. In these cases one can resort to r.f. filtering right at the individual transistors. The preamp stages are the place to start. One filtering scheme is shown in fig. 3. Here the transistor base lead is cut, and a 4.7K ¼ watt resistor is soldered in series with the base lead. Then a .001 mf capacitor with short leads is soldered directly from base to emitter. Using this approach it is not necessary to cut any PC board conductors, and the filtering is done right at the transistor.

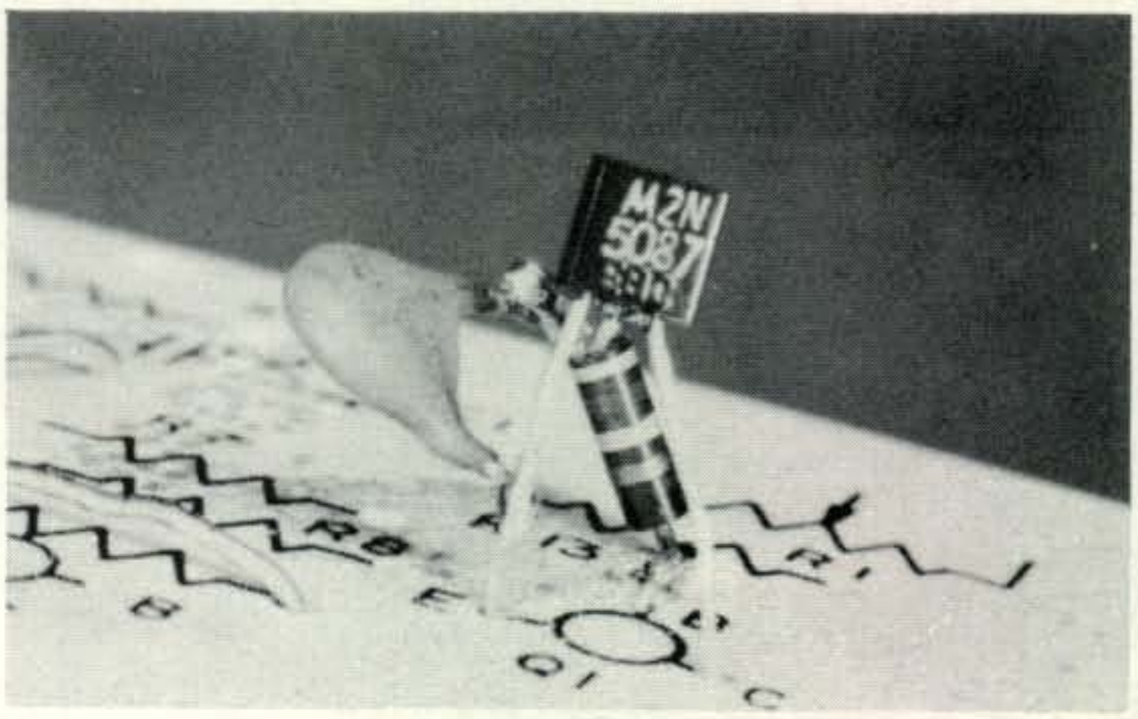


Fig. 3—When it is impossible to keep r.f. out of an audio amplifier, a simple *R-C* filter right at the transistor will often eliminate RFI.

Fig. 4—RFI in this cassette recorder was eliminated by keeping the interconnecting cable short, and powering the recorder with internal batteries.

Eliminating RFI is generally a step-by-step process. We've looked at several of these steps:

1. Chassis-to-chassis bonding of nearby units.
2. Filtering the a.c. input.
3. Filtering interconnecting cables.
4. Shielding.
5. R.f. filtering at individual transistor stages.

The order given is the order in which I would usually attack the problem, but there is nothing sacred about it. Sometimes going right to step 5 would be simplest. It's important to remember that the RFI may be coming into the unit via several routes simultaneously. Often you will notice a reduction in interference only when several corrective measures are taken *at the same time.* For example, if half of the interference comes via the a.c. line, and half via an interconnecting cable, eliminating either source will give only a slight reduction in the observed interference level. All r.f. highways into the unit must be blocked at the same time. As you work down the list, leave each modification installed even if it doesn't seem to help much. When the problem is finally solved you can go back and try removing the modifications one-by-one if you wish.

Some RFI Case Histories

A bad case of RFI in a reel-to-reel tape recorder housed in a wooden case was cured by filtering the a.c. line, filtering the input and output leads right at the connectors, and filtering the preamps right at the transistors. Shielding was not attempted.

The small cassette recorder shown in fig. 4 had interference problems when the a.c. adapter was plugged in and when long interconnecting cables were used. By using internal batteries and a very short cable to the rig, the interference was eliminated as long as the operator does not touch the recorder. (Yes, our bodies can be antennas too!)

A slow-scan monitor in a steel cabinet was cured of RFI by r.f. filtering the a.c. line, and by filtering the SSTV audio inputs right at the connectors.

RFI problems in a well-shielded slow-scan camera were solved simply by bypassing each lead of the camera cable to the camera case with .01 mf disc ceramics.

An f.m. receiver/stereo amp in a wooden case responded to a.c. line filtering, and bypassing each speaker lead to ground with .02 mf disc ceramics.

The toughest case was a solid-state color TV set where the RFI affected the video stages as well as the audio. The final solution required a good high pass filter, a.c. line filtering, and covering the inside of the plastic cabinet with aluminum foil.

'Til next time. Vy 73, Cop, WØORX

WANT TO BUY
OLD LIONEL TRAINS

My classified ads in CQ have been very productive in helping me acquire several new additions to my electric train collection.

There are still many Lionel models that I want quite badly, and I'll pay good cash or swap radios for just about any Lionel train in good condition.

The models I'm looking for particularly are as follows:

Twin Diesels -- Canadian Pacific No. 2373
Rio Grande No. 2379
B & O No. 2358
GG-1's (Pennsy Electrics) Nos. 2330, 2332, 2340, 2352, 2360.
Steam Locomotives Nos. 700E, 773, 763, 5344, 726.

Am also interested in any Lionel Standard Gauge equipment, as well as 0 gauge box cars, freights, passengers, etc. Your old trains in the attic or garage may be worth good money. Don't be bashful. Drop me a line and find out.

Dick Cowan
CQ Magazine
14 Vanderventer Ave.
Port Washington, NY 11050

WANT TO BUY -- USED HAM GEAR
We pay cash for used gear: FM, SSB, AM, etc. Working or as is -- makes no difference. Call or write today! Al, W2SRW or Mel, WA2NET.

RAMCO ELECTRONICS
365 Canal Street, New York, NY 10013
Phone: **(212)966-6056**

NOVICE SHACK

BY HERBERT S. BRIER,* W9EGQ

IF anything is better calculated to give a new c.w. operator an irresistible urge to retire his "straight" key in favor of an electronic keyer than observing an expert operate such a keyer, we cannot think of what it is. The operator of a straight key has to pound out each code character, dot by dot, and dash by dash. In contrast, the operator of the electronic keyer nonchalantly wiggles his hand a few millimeters from side to side a few times to send the same message. And it is almost as effortless as it looks for the expert. But Novices, do not throw away your straight keys yet. There are a couple of catches to using an electronic keyer, especially if your code is a little shaky. Before going into them, however, let us describe in elementary fashion how an electronic keyer works.

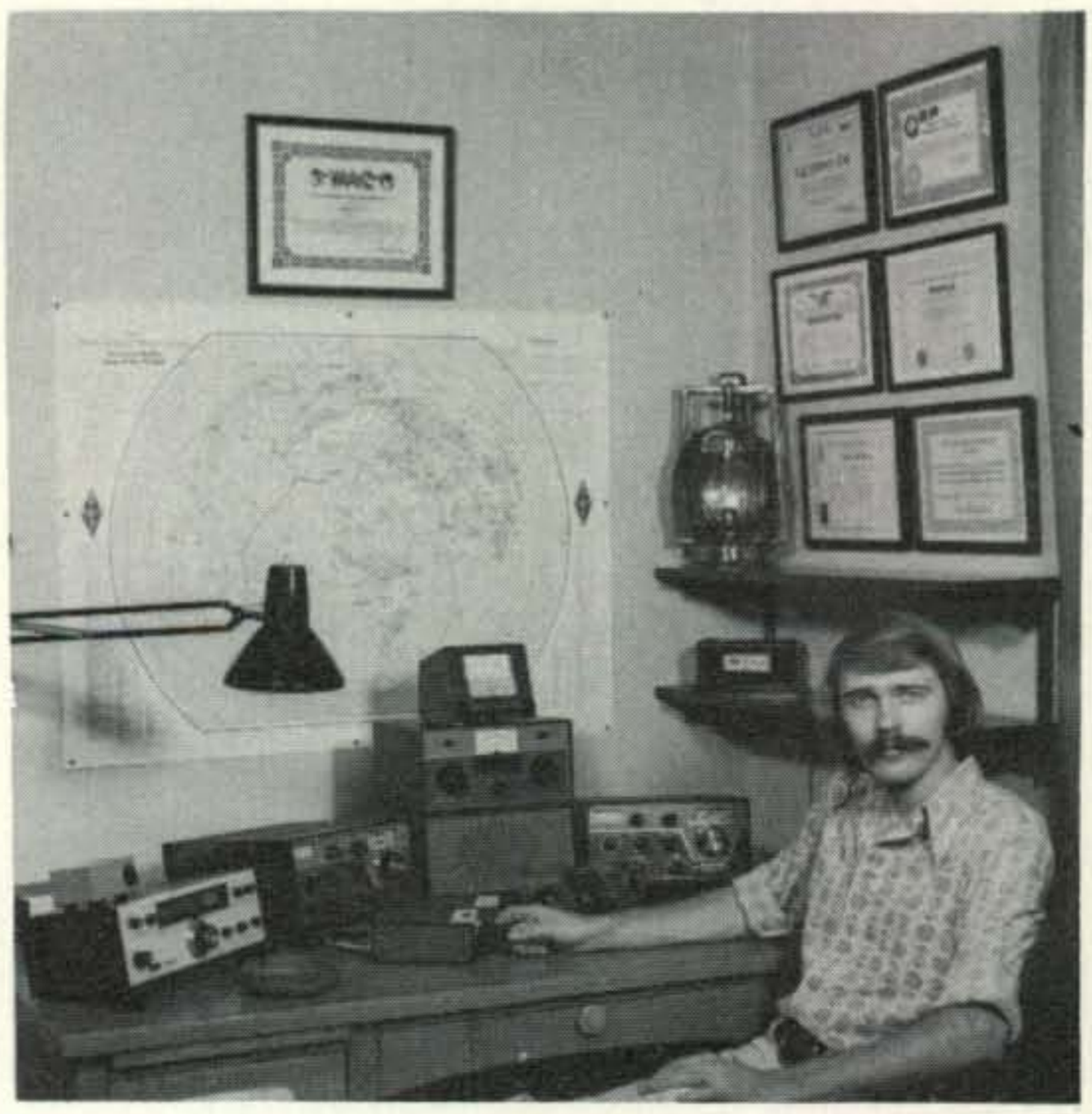
The keyer contains a "clock" that generates square waves at the highest speed at which it is desired to send dots. The clock feeds a keying transistor or relay through the dot contact of the control paddle. The clock also feeds a "frequency divider" which makes dashes three times as long as the dots but keeps the spacing between both the same. The divider feeds the keying circuit through the dash contact on the control paddle. A speed control varies the speed of the dots, dashes, and spaces all in the same ratio.

Pushing the paddle to the right generates a continuous stream of dots; pushing it to the left generates a stream of dashes. Thus, all the operator has to do to send perfect code is to swing the paddle, left and right, to mix the dots and dashes in the proper proportions. The timing must be precise, however. The importance of timing in sending dot characters is obvious, but it is equally important in characters containing both dots and dashes, because of the limited time in a character to reverse the position of the paddle. The problem is lessened by adjusting the lever for minimum spacing between contacts. Twin paddles, one for the dots and the other for the dashes, may also be used to halve the time required to change from sending dots to sending dashes and vice versa.

*385 Johnson St., Gary, Ind. 46402.

Twin-paddle electronic keyers equipped with self-completing circuits and built-in "memories" *(which insure that once a dot or dash is started, it will be completed and a unit space will elapse before another dot or dash can be sent)* will send alternate dot and dashes or dashes and dots (depending on which paddle is pressed first) as long as both paddles are squeezed. By alternately pressing and releasing them in the correct sequence, all the code characters can be sent with a minimum of wasted motion. We emphasize again that precise timing is the first requirement in mastering any electronic keyer, however it is used. A built-in keying monitor or other means of listening to your own sending is only slightly less important.

The delicate touch required to control an electronic keyer can be achieved with practice. In the meantime, however, your ability to send good code on a straight key deteriorates at least temporarily.



Peter Sils, WN8PJR, 15103 Clifton Blvd., #2, Lakewood, Ohio 44107, wins a 1-year subscription for CQ for submitting this picture. Peter uses a Drake T-4XC transmitter cranked down to 75 watts and a Drake R-4B receiver, and a Ten-Tec Argonaut transceiver usually operated at two watts input. His antennas are a Mosley TA-33JR, 10, 15, 20-meter rotary beam, 40 feet high and separate 80 and 40-meter inverted V's. The Worked-All-Continents (WAC) certificate and 40 countries worked speak for themselves. The 2-watter worked Hawaii and England on 15 meters in September. If you would like to try for the free 1-year subscription we award to the sender of photograph we choose as the best picture of the month, send a sharp photograph (preferably black and white) of you at the controls of your station and some details about your amateur career to: CQ Novice Shack Photo Contest, c/o Herbert S. Brier, W9-EGQ, 385 Johnson St., Gary, Ind. 46402.

Ken Anderson, WN5LIT, had an unusual "breaker" in a recent contact. Details in "News And Views."

What happens when the operator goes back to a straight key after a session with an electronic keyer is that the multi-dot and multi-dash combinations come out as long dashes as he waits for the key to do the work, instead of pumping it manually. Of course, an operator can become proficient on both types of keying machines by diligent practice. The question is, though, whether a Novice is wise to spend the time that he could devote to preparing for his General-class examination to learn to operate an electronic keyer, considering that he will have the rest of his radio life after becoming a General to devote to the task. On the other hand, we know that many Novices use electronic keyers, and some of them use them very well, indeed. Incidentally, the FCC will allow you to carry your own battery-powered keyer with you into the FCC office to take the sending test on.

Many electronic keyers are advertised in *CQ* and other magazines in kit and finished form from approximately $10 to well over $100. The lowest priced ones are not always the cheapest, by the way. Some of them are sold without the paddle mechanism, which can add $20.00 or more to the total cost. A very acceptable twin-paddle mechanism can be constructed, however, by mounting two standard straight keys, back-to-back, on their sides on a rectangle of metal heavy enough to prevent the device from walking across the operating table in use.

Members of the First Ave. School Amateur Radio Club, Arcadia, Calif., 91006, comparing a Heathkit electronic keyer with a straight key. The knobs on the keyer are its speed control and the volume control for the built-in keying monitor.

Sources of Electronic Keyers

Curtis Electro Devices, Inc., Box 4090, Mountain View, Ca. 94040. $140-300.
Data Engineering, Inc., 5554 Park Royal Rd., Springfield, Va. 22151.
Hal Communications Corp., Box 365, Urbana, Il. 61801. $75. less paddle.
Heathkit, Benton Harbor, Mich. Kit, $40.
Matric, Box 185, Franklin, Pa. 16323. Keyer, $35. Paddle, $10.
MF-J Enterprises, P.O. Box 494, Mississippi State, Mississippi. $35, Four penlight cells extra.
Ten-Tec, Inc., Sevierville, Tn. 37862. Three models with paddles, $38-100.
Vibroplex Co., Inc., 833 Broadway, N.Y., N.Y. 10003. Paddles $28 and $33.

Operating Events of Novice Interest

10-Meter Contest, 1200 GMT Dec. 14, to 2359 GMT, Dec. 15. Everybody works everybody in this event. U.S. and Canadian amateurs send signal reports and names of states and provinces. DX send reports and serial number. Scoring: Two points for complete exchanges. Novices worked four points. Total score is sum of contact points multiplied by sum of states, VE call areas, ITU regions (Non land based stations), and different countries woked. Suggested frequencies for Novice, 28.1-28.15 mHz. Scores go to ARRL, Newington, Cn. 06111.

Straight-Key Night, 0100-0600 GMT, Jan. 1, 1975. No contest. Just amateurs working each other using straight keys and exchanging signal reports preceded by "SKN." Send list of station worked and your vote for best "fist" heard to ARRL, Newington. Cn. 06111. Most Novice activity will probably be in the lower 10 kHz of the 3.7 and 7.1-mHz Novice bands.

News And Views

After the local amateur radio club showed a decided lack of interest in holding classes for prospective amateurs, **Ted Herrman, KZ5VV,** Panama Canal Zone, did the job himself. Between February and July, he turned out 13 new Novices, KZ5CZN, JAN, LBN, MON, ASN, DXN, QXN, RBN, XQN, XYN, RSN, BJN, and XGN. A couple of them have already earned their General tickets but still work the Novice bands. As **Jake Meyer, KZ5JA,** P.O. Box 415, Balboa Heights, C.Z., said, "It will be better

[*Continued on page 74*]

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

OVER the past several months we have received several letters from readers of this column asking for a "practical review" in the application of light emitting diodes. As a result, we will devote this months column to the "care and feeding" of these devices.

The light emitting diode (or LED as it is commonly called) is electrically, nothing more than a specially fabricated diode and therefore exhibits all diode characteristics. Where it differs from a conventional diode however, is when it is forward biased. At this time, it emits light which, with todays units can be either red, green, yellow or invisible (to the eye) infra-red depending on the semiconductor materials used in the fabrication of the particular device. The general design procedure for the use of any of the four varieties is the same however.

Fig. 1 is a schematic of the basic LED circuit. Because of the fact that the LED is a forward biased diode, a resistor is necessary to limit current flow to a safe value.

Brightness is proportional to the current flowing through the LED but, like a conventional diode, too much current can damage the device. A little simple arithmetic is all that is necessary however to determine the value of the current limiting resistor. All of the necessary parameters for the formula in fig. 1 (maximum current and diode forward voltage drop) can be obtained from the data sheet for the particular LED to be used. Typical figures incidentaly are 1.5 volts for the diode forward drop and 20-30 milliamperes for the maximum current. When used as a pilot light indicator therefore, it is easy to see that the total power required for a LED and resistor (Vsupply × Idiode) is much less than that required for a conventional pilot lamp. As an example of this

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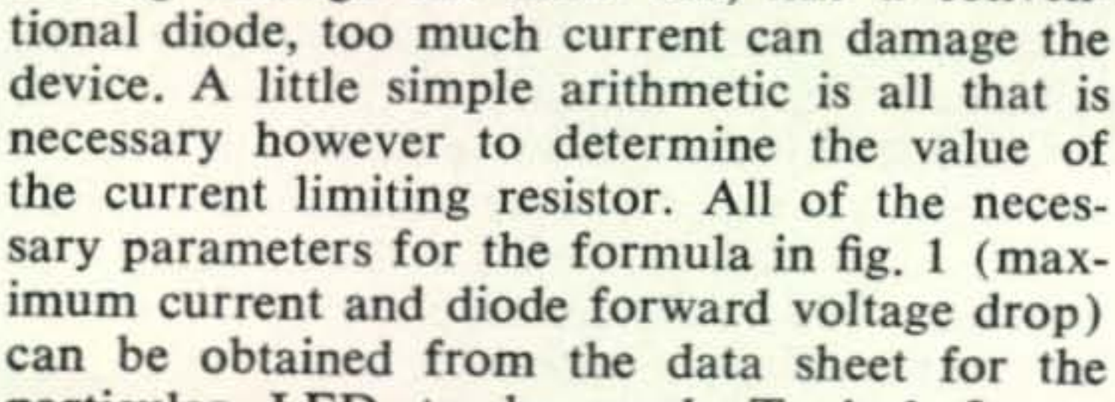


Fig. 1—A typical LED hookup.

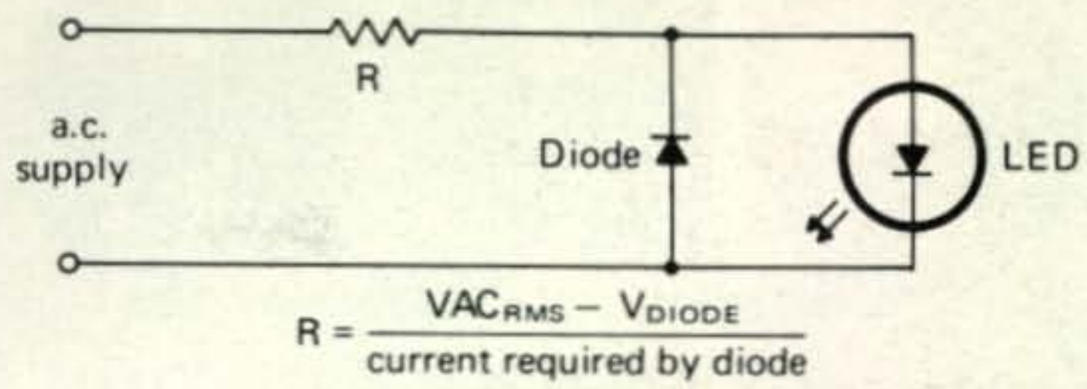


Fig. 2—Using an LED with a.c.

consider the case of the popular #47 lamp which requires 150 milliamperes at 6.3 volts, almost 1 watt. An LED used for this purpose, operating from the same 6.3 volts, would only require 20 milliamperes—a power of .126 watts or roughly 10 times less. Also, since the LED is a semiconductor device, its ruggedness and life will be many times that of the pilot lamp. In fact the only drawback is the amount of light output from the device which is less, but still completely adequate for almost all indicator requirements.

One can also use a LED with a.c. in the same circuit as fig. 1. Here, the positive half cycle of the a.c. will act as the forward biasing voltage while the negative half cycle will simply reverse bias the diode and cut it off. The resulting 60 Hz flicker is not noticeable by the eye and the final result seems the same. Care must be taken in this application however, to assure that the reverse voltage breakdown level, which is quite low in many LED's is not exceeded. In case this is a problem, it is only necessary to add a low cost diode in parallel with the LED as shown in fig. 2. This diode will conduct in the reverse direction of the LED thereby limiting its reverse voltage. Note that the RMS value of the a.c. is used for the resistor calculation in this application.

The low current and polarity sensitive features of light emitting diodes offers many interesting and unique possibilities for the experimenter. Fig. 3 is an example of a typical circuit made possible by these characteristics. Here the LED is used in several ways. The first, exactly as shown, is as a simple polarity indicator. Depending on the input polarity the diode that is forward biased will light and the other will remain off. Putting a.c. into this circuit will cause both diodes to light, therefore it can be used as an a.c./d.c. detector. If the circuit is connected to the output of a communications receiver however, it will serve as a zero-beat detector when adjusting the internal

[*Continued on page 72*]

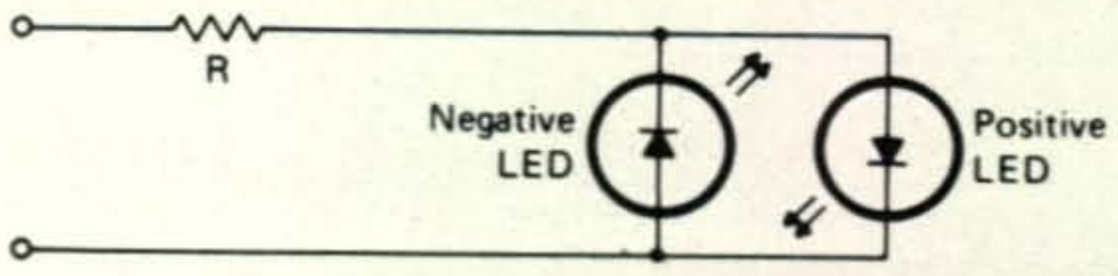


Fig. 3—The LED circuit described in the text.

QRPp

LOW-LOW POWER OPERATING

BY ADRIAN WEISS,* K8EEG

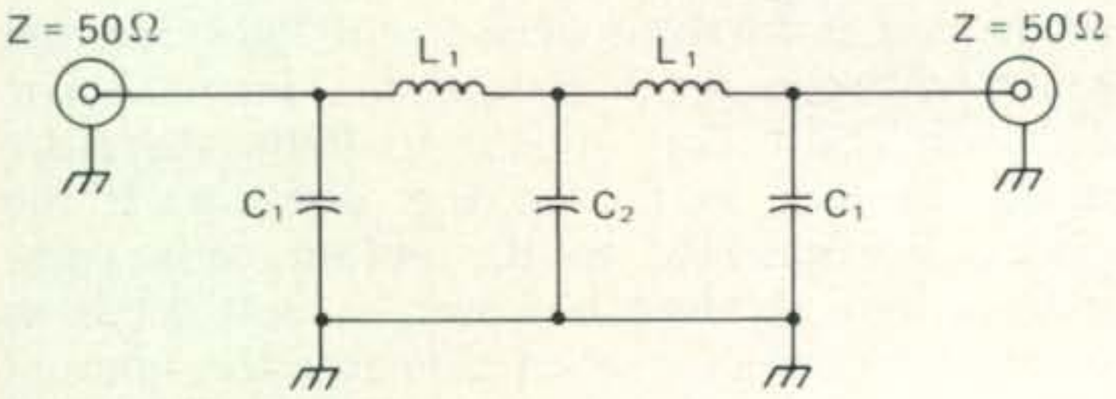
Efficiency In The Antenna System

As anyone who has had to copy a weak QRPp signal in the QRM will verify, a one dB difference in signal level often can make the difference between copy and no-copy. I know that for a fact also. During the August QRP Contest, I worked a string of about 17 stations on 80 meter c.w. with some pretty bad QRN problems. All contacts were eventually completed, but oftentimes taking about 15 minutes to get across the simple exchange information. I often wished that the other guys had been able to squeeze just another dB output during those couple of really tough hours of copy. That would have made all the difference in the world! So, let's review the ways and means of making certain that you aren't wasting that dB of signal that could make the difference in a rough QSO.

Mechanical Losses and Their Cure

Before we even start to consider the esoteric theory on s.w.r. and its effect upon antenna system losses, we have to clear up the simple sources of signal loss. The first of these, and a very common source, is the poor solder connection. When an antenna is buffeted by winds and rain and snow, plus all the pollutants floating around in the atmosphere these days, the solder connecting the feedline to the antenna itself is bound to corrode and introduce some real resistance between feedline and antenna.

*213 Forest Ave., Vermillion SD 57069.



F (mHz)	3.5	7	14	21	28
L_1 (μh)	2	1	.55	.35	.17
C_1 (pf)	820	470	220	180	110
C_2 (pf)	1500	1000	470	390	220

Fig. 1—A half-wave filter.

This connection should be inspected periodically for corrosion, but it is likely to be there. The best way to avoid the problem is not to rely merely on solder. Best to use a screw, nut, and washers combo to pressure clamp the feedline to the antenna, then solder the wires together, and finally, weatherproof them with a healthy wrapping of good plastic tape or a glob of plastic insulating material. Similarly, every connection that is made along the feedline-antenna path should be checked—solder connections resoldered periodically, coax receptacles and plugs steel-wooled clean, the ground connections between coax receptcales and chassis cleaned and tightened. Likewise, the ground wire-cold water pipe connection should be cleaned. If a transmatch or antenna tuner is used, check it thoroughly.

Feedline Loss

An old, frazzled piece of coax used as a feedline can burn up more r.f. energy than you would expect. Coax should be replaced if any noticeable signs of deterioration can be spotted. After several cold winters in the open, the coax dialectric can deteriorate also. When checking the coax, don't forget the solder connections to the coax plug—these can wear loose in time. One easy test that should turn up any serious defect in the r.f. handling capability of the coax is to first measure the r.f. voltage across a dummy load, and then connect the dummy load to the far end of the coax without touching the transmitter tuning; any noticeable difference in power delivered to the load is an indication that the coax has deteriorated.[1]

Choice of coax for feedline is important. Depending on construction, size of inner conductor, and spacing, a feedline will exhibit real resistance which dissipates r.f. energy fed through it. To give you the picture, Table I lists the attenuation per hundred feet of four types of feedline—RG-58U and RG-8U coax, and 300ohm open line with seven strands of #21, and solid #16 copperweld lines. Deviation from 100 ft. lengths is linear.

Loss in dB per 100 ft. at Frequency

Type	3.5 mHz	7 mHz	14 mHz	21 mHz	28 mHz
RG-58U	0.69	1.1	1.5	1.95	2.35
RG-8U	0.31	0.45	0.65	0.82	0.95
7/21 open	0.2	0.28	0.42	0.52	0.62
#16 solid	0.12	0.17	0.25	0.32	0.39

A glance at this table tells the tale. If you are using brand-new quality RG-58U at 7 mHz, and need a 100 ft. run, regardless of antenna match you are burning up 1.1 db of your signal just getting it to the antenna. To put this

[1] See also the technique suggested in *The A.R.R.L. Antenna Book* (Newington, CT, 1968), p. 85.

into realistic terms, if you are putting 1 watt into the feedline, only about 750 milliwatts gets to the antenna. For RG-8U, it comes out about 910 miliwatts. For the #16, about 970 miliwatts. You're in the wrong ball park if you are using that miniature RG-174U. If you are, I'll let you look it up for yourself.

SWR and Line Loss

A common myth that has been floating around since the introduction of coax is that *reflected power* is somehow *wasted power*. That is, if the s.w.r. meter reads 10 watts forward and three watts reflected, then the antenna is only radiating the difference, or seven watts. Not so. The actual loss caused by s.w.r. varies with the line attenuation referred to above and is quite negligible when a low loss line is used. To cite some examples, let me refer to the *A.R.R.L. Antenna Book*, Fig. 3-18, p. 77. If the feedline attenuation when perfectly matched to a load of its characteristic impedance is 1 db, an s.w.r. of 2:1 will add 0.21 db additional loss; 3:1 will add 0.5 db additional loss; 5:1 will add 1.2 db additional loss. To return to our RG-58U at 7 mHz again, the total loss for 100 ft. with a 3:1 s.w.r. will be 1.1 db line loss plus 0.53 db additional loss, or 1.63 db. However, if we use RG-8U in the same case, it comes out to line loss of 0.45 db plus 0.25 db additional s.w.r. induced loss, or 0.8 db total loss. So, operating with 100 ft. of RG-8U at a 3:1 s.w.r. is clearly better than operating with perfectly matched RG-58U. Of course, with the # 16 solid open line, the figure is 0.17 db line loss, plus 0.2 db s.w.r. induced, or 0.37 db total. Take your choice. To reiterate, s.w.r. of itself causes very negligible signal loss.

SWR and Harmonics

Inaccurate s.w.r. readings are often caused by the presence of harmonic energy in the output signal. If your antenna is cut to frequency either with an r.f. bridge or according to handbook formulas (which come out very close in practice), and you have a 2.5:1 s.w.r. or higher there is a good chance that the reflected reading is actually caused by harmonics. There is no sense in putting a signal into the feedline that is 60% fundamental and 40% harmonic. Strive for signal purity. Insertion of a simple half-wave filter in the feedline will usually drop harmonics about 25 dB or better. See fig. 1 for details. Of course, the filters should be shielded so that no harmonic leakage occurs.

Matching Transmitter and Feedline

Unless the characteristic impedance of the feedline exactly matches the radiation resistance of the antenna, there will always be an s.w.r. of above 1:1. It is not absolutely necessary to have a perfect match between feedline and antenna, and such is well-nigh impossible to

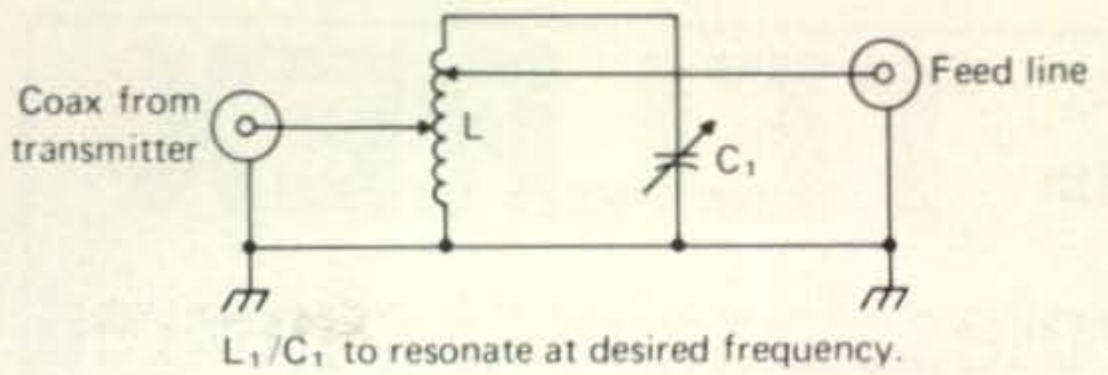


Fig. 2—A simple transmatch.

achieve, because the radiation resistance of the antenna is affected by many factors, such as height above ground, proximity to surrounding objects etc. Furthermore, the antenna will eventually radiate all power fed into the feedline (minus line losses) regardless of s.w.r. The reflected waves eventually recombine with the forward waves to be radiated. The problem point to be dealt with, then, is the match between transmitter and feedline, because power can be wasted there. If your antenna has an s.w.r. of somewhere around 3:1 or worse, and your rig just won't load up into the antenna, you need some sort of matching device, such as a transmatch or antenna tuner. A simple transmatch which will match your transmitter output to a coax or open feedline is shown in fig. 2. The input and output taps are varied until a good match is obtained. You can take a chance and adjust the match for lowest s.w.r., read between the transmitter and transmatch, but that can be deceptive at times. It is best to insert a #49 or #47 bulb in series with the output lead and tune for highest indication of r.f. current. Or, a field-strength meter can be used to monitor radiation from the antenna during tune-up. By juggling the taps, you should be able to get a very low s.w.r. and high output indication at the same time.

When using open wire feedline, it is best to

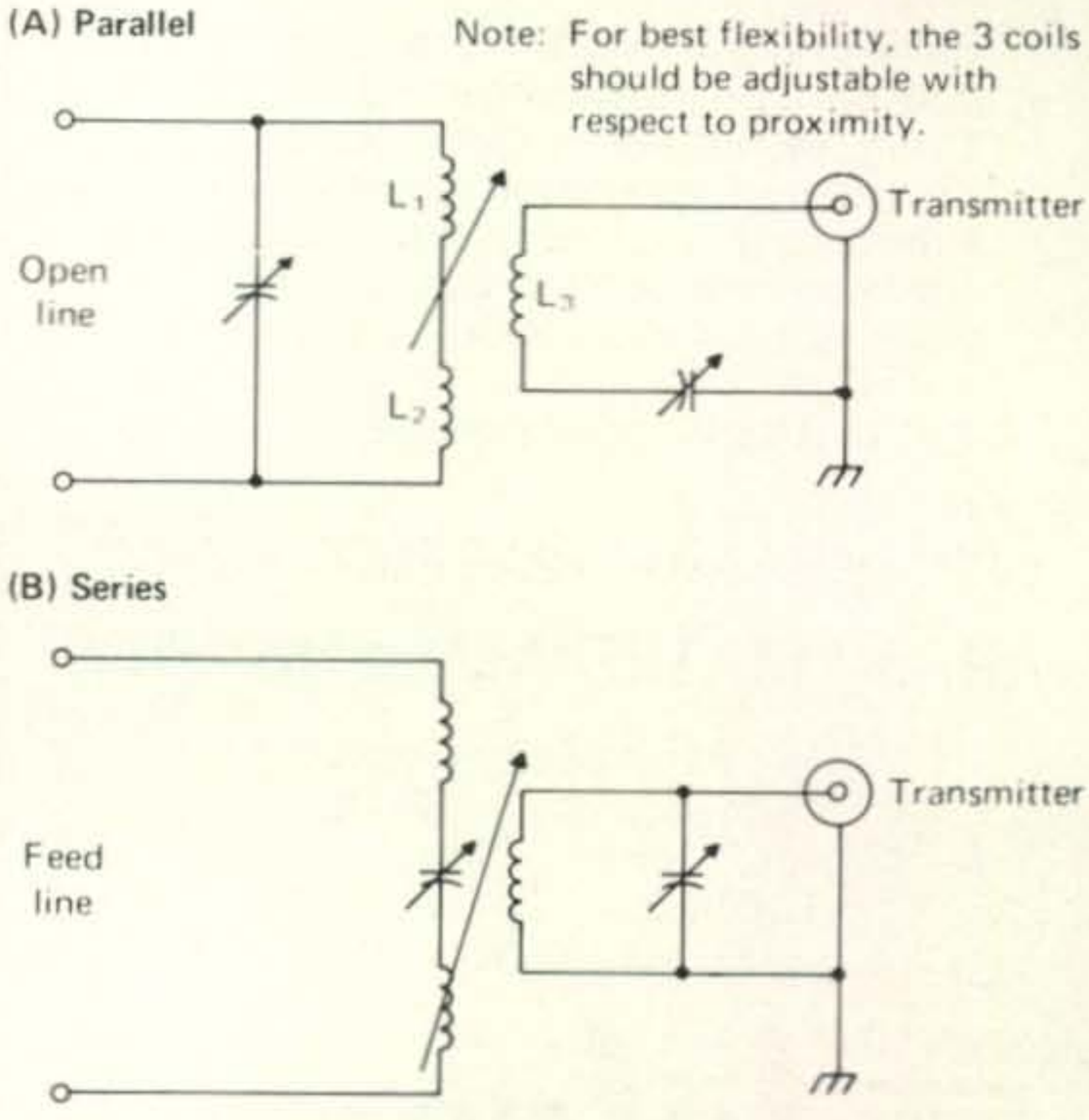


Fig. 3—A lumped constant transmatch for open line feeder.

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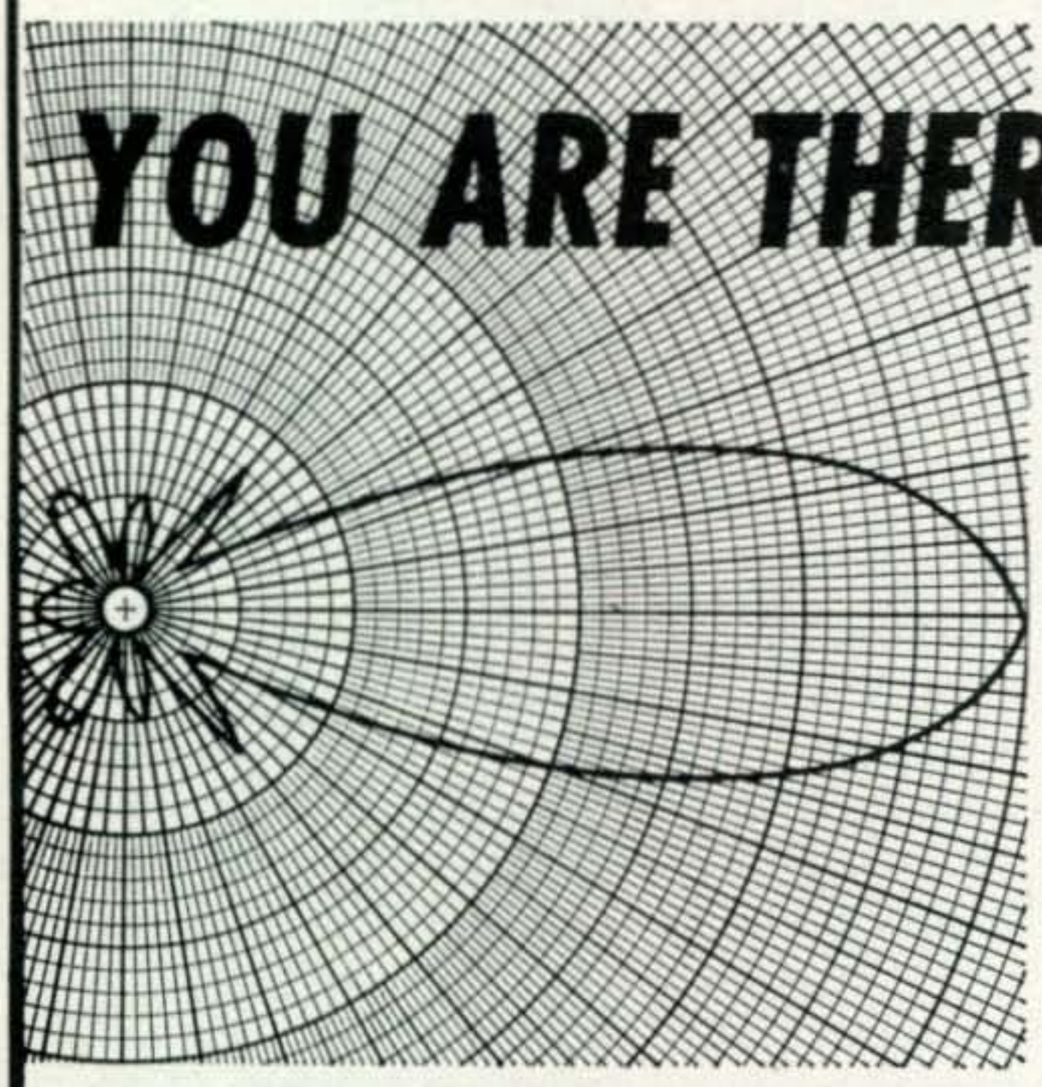

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connect the feedline across a lumped capacitance/inductance. In many of the transmatches published in the literature which used tapped coils and dual-capacitors, it is possible to achieve a perfect 1:1 s.w.r. with no r.f. power going to the antenna—the transmatch itself is dissipating all the energy! So, again, small bulbs in the feedline is the only way of getting a positive indication that a low s.w.r. is an actual indication of power going to the antenna. See fig. 3 for parallel and series tuned lumped constant circuits. Best results are obtained if the link coil is adjustable with respect to its positioning in the main coil.

Ultimately, all of the above procedures will result in improvements if anything is wrong with your system. The one true and trustworthy way of determining whether your system is working, or is being improved by some adjustment, is the laborious route of positioning a field-strength meter a wavelength or so from the antenna in question, and monitor the signal strength after each adjustment is made without retuning the rig. If the F/S reading goes up, the juice is getting into the ionosphere where it should be!

Milliwatt Research Group

We are still looking for QRPp operators interested in an organized experimentation with very low power levels on the order of 200 milliwatts and below. Tests will run until the end of the good season in late spring or so. This will be basically an individual effort with published results at the end. If interested, drop me a card.

WB9MBH is interested in doing some serious scientific experimentation with 10 milliwatts and under. He is looking for individuals with the capability of sophisticated weak signal reception techniques. If you fit, and want to join in the effort, drop me a card.

Don't forget the DL/AG QRPp DX Contest coming up in January. See elsewhere for announcement and details.

Transatlantic QRPp DX Tests

We are in the process of setting up transatlantic QRPp DX tests for several weekends in February and March. The choice of times and frequencies is still to be determined. What we need is a group of QRPp'rs on both sides of the Atlantic who will show up at the selected times and attempt to establish contact across the pond. Similar to W1BB's 160 DX tests. Foreign hams should write to Gus Taylor, G8PG, 37 Pickerall Rd., Greasby, Upton, Wirral, Cheshire, England. Others drop me a card.

That's it for this month. It's time again to start collecting QRPp WAS and DXCC standings. Drop me a card with your standings pronto.

73, Ade, K8EEG/Ø

Loss In Transmission Line Systems

BY WILLIAM J. LaHIFF,* W2IVT

It was so good back in the old days. A transmitter was usually a simple oscillator-amplifier type (fig. 1) with the antenna tuning circuit coupled to the tank coil. It was merely necessary to connect the open wire feeders to L_1, C_1 and tune for maximum antenna current. We knew nothing about s.w.r., the 1934 ARRL *Handbook* mentions only a "standing wave" once and states that variations of voltage along the non-resonant line are not good. The transmitter was complete. Only a single wire antenna or an antenna with open wire feeders was required to put a signal on the air. Also, the choice of antenna and feed line was simple, one of three: a straight wire (tapped on the tank coil), a single wire fed dipole (Windom), or an open wire line feeding a dipole at the end (Zepp) or the center, known as current feed.

The overall efficiency was excellent. The curbstone engineering was that from the plate of the vacuum tube an approximate loss of 20 percent (no decibels, either) would occur in the tank coil, the coupling coil and the open wire feeder. This combination would match almost any antenna system and external matching devices, with the attendant losses were not required. A transmitter rated at 100 watts output would deliver full power to the antenna at any frequency.

*3489 Fort Independence St., Bronx, NY 10463

Birth of a Problem

Somewhere along the line things became complicated, maybe sometime following War 2. The radio manufacturing companies required a peacetime market and some elected to sell amateur radio transmitters. Perhaps a non-ham radio engineer who had designed fixed frequency transmitters during the war designed out the pre-war wide range output circuit and designed in a circuit suitable only for coaxial cable. He did not know much about antennas and his company had 4650 Type N, 50 ohm coaxial connectors in stock. As a result the 50 ohm transmitter output was born.

The Antenna Problem

As shown in the chart (fig. 2) only a very low (physically) center fed dipole has a feed point resistance of 50 ohms and the majority of antennas supported at reasonable heights above ground show a resistance of

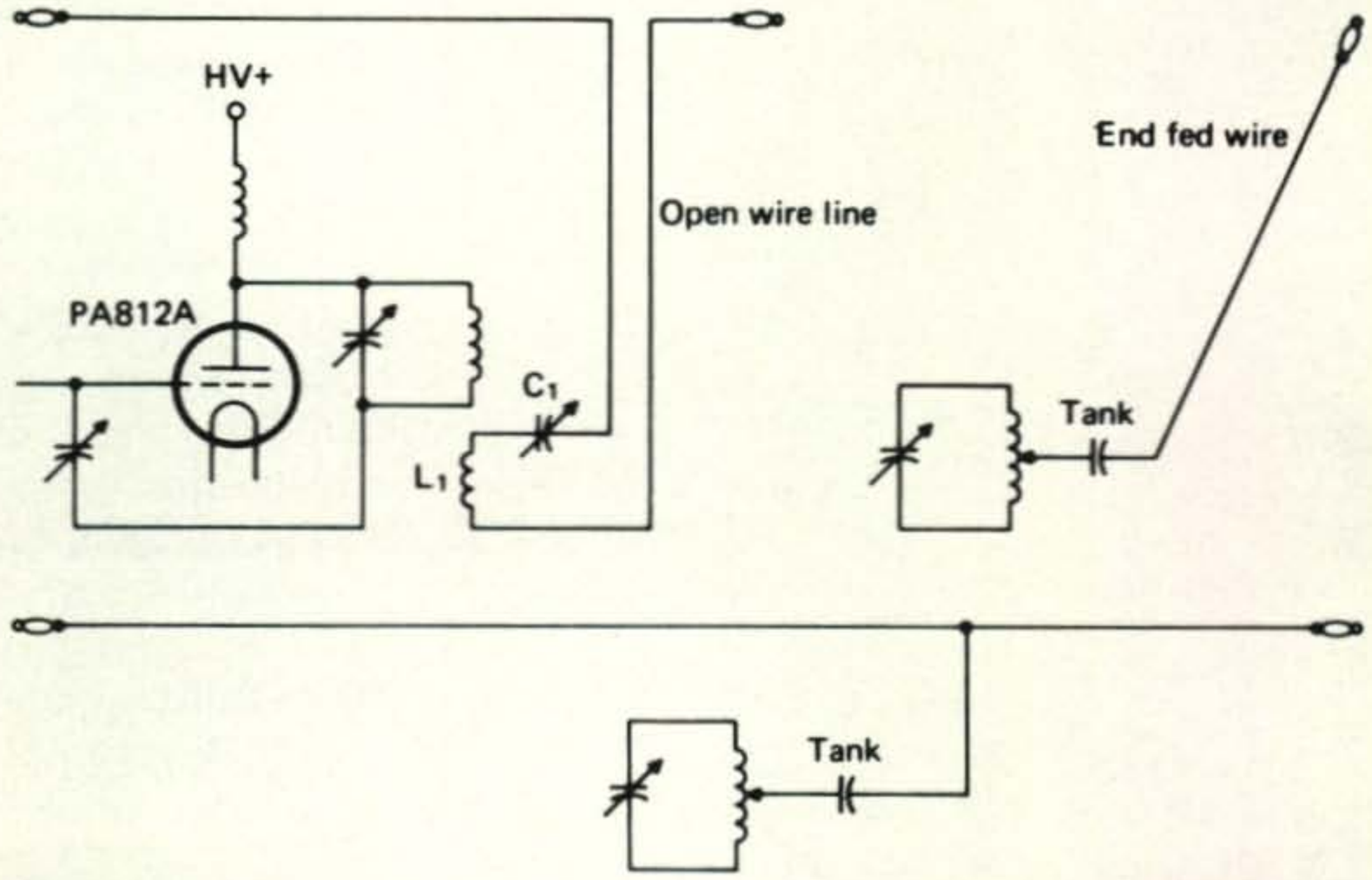

Fig. 1—In earlier days, coupling to the transmitter was a simple matter. Link or direct coupling was the order of the day. Coupling and line losses were low.

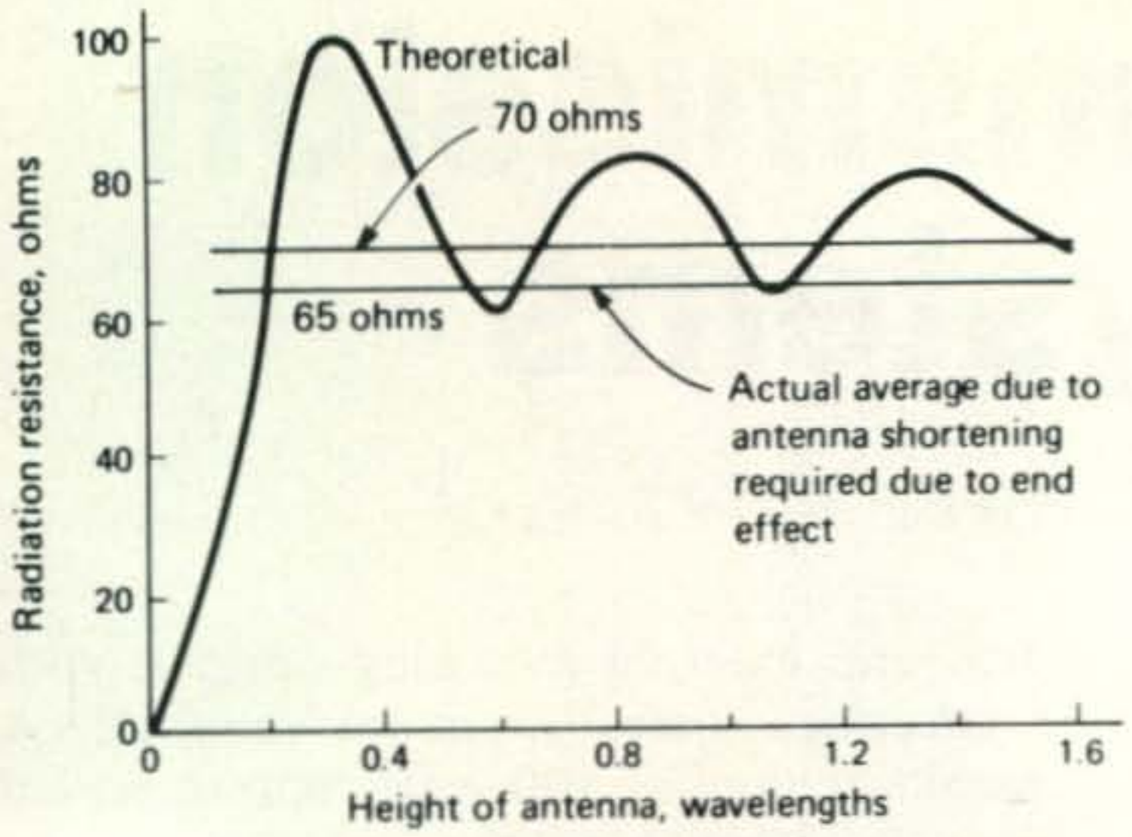

Fig. 2—Radiation resistance variation of a dipole antenna as a function of height above ground.

65 to 70 ohms. It is too bad those 4650 surplus connectors were 50 ohms. Seventy five ohm connectors would have been a better choice.

The Transmission Line Problem

Only the 75 meter man can be completely happy with the modern manufactured amateur transmitter. The antenna may be low enough so the radiation resistance does provide a good match to the 50 ohm coaxial cable. In fact, some do adjust the height of the antenna for the lowest s.w.r. reading. The frequency of the transmitter is never changed and some are compared with the pre-war crystal from the old a.m. rig.

With these conditions the simple coaxial line transmission system with the usual ferrite balun will operate with fair efficiency with a loss of 1.3 decibels. From the chart of fig. 3 decibels versus efficiency, it can be seen that a 100 watt output transmitter will deliver about 73 watts to the antenna terminals. This assumes very low s.w.r., 100 feet of RG-8/U cable (0.3 decibels loss) and a good ferrite balun (1.0 decibels loss) with the transmission line running away from the antenna at a right angle for a reasonable length.

Loss (decibels)	vs	Efficiency (%)
0		100.0
0.25		94.5
0.5		89.0
0.75		84.0
0.1		79.5
1.25		75.0
1.75		67.0
2.0		63.0
2.5		56.0
3.0		50.0
3.5		44.0
4.0		40.0
4.5		35.5
5.0		31.5
6.0		25.0
7.0		19.5
8.0		16.0
9.0		12.7
10.0		10.0

Fig. 3—Efficiency vs. decibel loss on a transmission line.

At this point it would be reasonable to remove the balun from the system. The balun does cause the greater part of the system loss and if it is eliminated the power at the antenna terminals will be 92 watts. As a second reason for removing the balun, Carl Drummeller, W5JJ (*ham radio*, May '73) has proven by experiment that the only real advantage of the balun is the maintenance of a balance of voltages on either side of the dipole. Considering the location of the average amateur antenna, where the surrounding objects have a major effect on the dipole balance and the field pattern, it appears that the balun offers no advantage to the ham.

Thus far we have considered the coaxial line and balun as a non-resonant transmission line system. If it is desired to operate at a frequency removed by only a few percent from the resonant frequency, a standing wave will occur on the transmission line and the system must then be considered as a resonant system. As a result the balun will then operate under conditions for which it was never intended and very high s.w.r. will occur with increased losses. From tests made on several baluns offered for sale to amateurs the loss in a balun operating into an s.w.r. of 2 is quite high and the loss operating into a 200 ohm resistive load is prohibitive. Numbers are not expressed because accurate measurements cannot be made, but a definite value was noted far in excess of the manufacturers numberless specification of "insertion loss, negligible."

When a transmission line system is lossy and all are lossy to some degree, the loss tends to mask the s.w.r. as read on a Micromatch, Monimatch or power meter type of standing wave indicator. In fact, if the transmission line is made long enough so the loss is considerable, say 20 decibels, the line may be used as an excellent dummy load. As described in a previous article by the author[1] the radio frequency energy sent to the source end of the cable will travel along the line with a loss of 20 decibels when the end of

[1] LaHiff, W. J., "High Power VHF/UHF Dummy Loads," *CQ*, July '65, p. 35.

the cable is reached. At this point total reflection will occur and the power will flow to the source for a total of 40 decibels with the result that low or unity s.w.r will be indicated.

Figure 4 illustrates s.w.r. correction required when a loss is present on the transmission line. As an example, when the transmission line has a specified loss of 1.3 decibels and the s.w.r. measured with a standing wave indicator is 2.5 the actual s.w.r. proves to be 3.8.

To arrive at the overall transmission line loss this s.w.r. figure of 3.8 together with the original loss figure of 1.3 decibels may be applied to another chart (fig. 5) to determine the additional line loss caused by standing waves. The additional loss is one decibel making an overall line loss of 2.3 decibels so only 58 watts is fed to the antenna terminals. We can make a further excursion in frequency to where the s.w.r. is 3 for a system loss of 3.6 decibels. Congratulations, you are now eligible for membership in the QRPp club. If you are not ready for this, remove the balun. It does not belong in a resonant line system.

Without the balun and the associated loss a large change in the line loss situation is evident. The drop in line loss from 1.3 to 0.3 decibels makes operation at high s.w.r. levels without exceptionally high losses a possibility. If an s.w.r. of 2.5 is measured and referred to fig. 4 the actual s.w.r. is only 2.7. Inserting this figure, together with the 0.3 decibel original loss to fig. 5 shows an increase of only 0.15 decibels due to s.w.r. The total attenuation is then 0.45 decibels with 90 watts to the antenna. Even a measured s.w.r. of 4 will indicate only an 4.6 s.w.r. with an increase of less than 0.4 decibels for a total of 0.7 decibels loss with 85 watts to the antenna.

This is the transmission line problem. The pre-war transmitter with the wide impedance range output circuit would match these conditions with ease.

Compensatory Techniques

Unfortunately, only a few transmitters of the current manufactured types will operate satisfactorily into an s.w.r. greater than 2. This makes it necessary to install a Matchbox, Transmatch or other matching device to provide a match to high s.w.r. loads. Unfortunate, because like all other devices the matching circuitry has losses which again

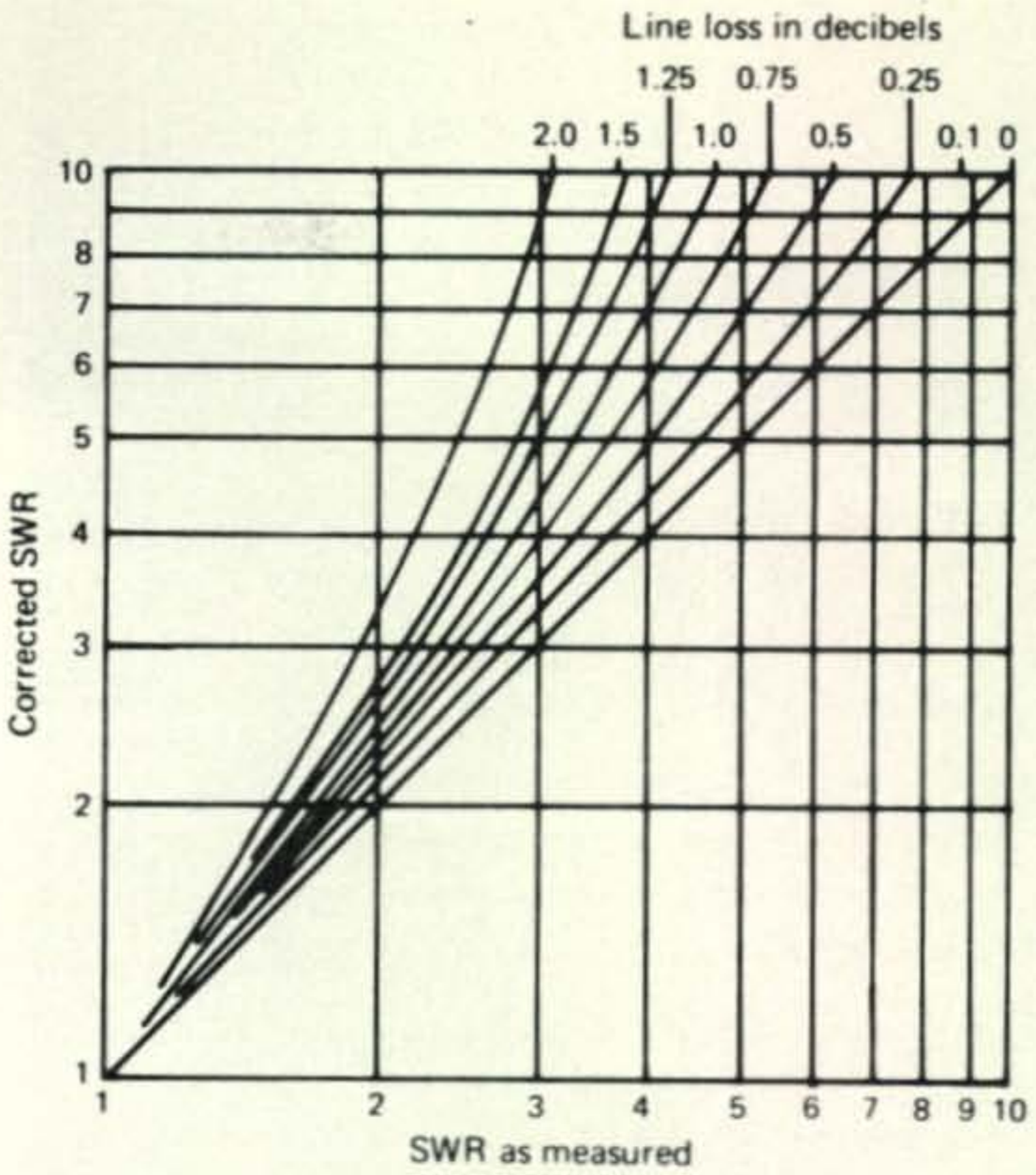

Fig. 4—Correlation curves for attenuation on transmission line.

are approximately one decibel.

It does look at first glance that we are right back where we started, but this is not so. The matching device is located at the sending end of the cable and when properly tuned it provides a match to the cable so all of the reflected wave coming down the cable is returned. The function is the same for all frequencies and the loss of the transmatch is constant over the whole of the 80 meter

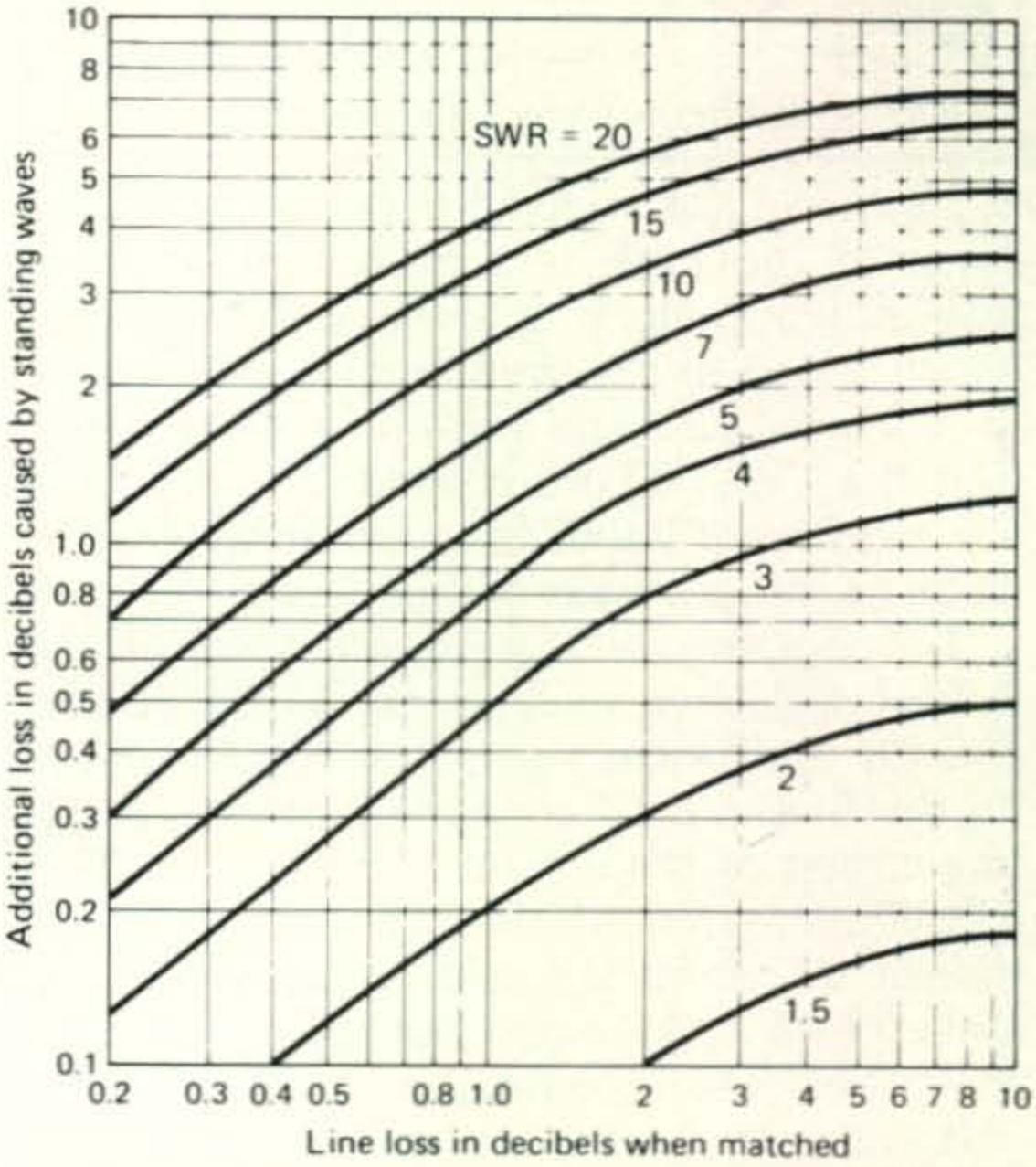

Fig. 5—Additional line loss caused by standing waves.

SST T-1 RANDOM WIRE ANTENNA TUNER

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band and is not affected by s.w.r. When the s.w.r. of the cable is a maximum of 4 the loss in the cable is a total of 0.7 decibels which added to the transmatch loss is a total of 1.7 decibels. The power to the antenna over the whole 80 meter band will vary from a maximum of 73 watts to a minimum of 69 watts at the extremes of the band.

To improve on this situation something radical will have to be done. You can borrow the XYL's can opener so you can modify the final amplifier to the tank coil/coupling circuit of the old time transmitter. This will eliminate one decibel of loss due to the transmatch, resulting in a power to the antenna of 93 to 85 watts. But this is a radical approach; you might damage the can opener.

A more moderate approach is to replace the coaxial line with an open wire feeder. This feeder has a minimum loss over the 80 meter band and the other high frequency bands through ten meters. The loss over the whole range now is the maximum of one decibel over the range of 3 to 29.7 megacycles, with 80 watts of power delivered to the antenna. The loss is essentially from the transmatch.

An important point: note that the charts of fig. 4 and fig. 5 cannot be used under these conditions. A little study is indicated here. When you realize the import of the charts you will have a fundamental command of transmission line theory.

Open wire transmission line is the most practical approach to antenna feeding over the frequency range of one through twenty nine megacycles and this type of line is widely used in broadcast and commercial communications applications, as well as practical amateur installations.

It is possible that open wire line cannot be used at a particular location, as is the case at W2IVT, where the transmission line must be threaded through many fire escapes en route to the roof. Very low loss coaxial line which has no more loss than open wire line may be used and many types with large diameters and extremely low loss are available, but at rather high prices. A good compromise is the JT200 Type manufactured by Times Wire and Cable Co. This cable has lower loss than RG-17U and is light enough so installation is not a problem. The loss for one hundred feet is only .11 decibels at 3.5 megacycles and 0.3 decibels at 30 megacycles. However, it is comparatively inexpensive when compared to air dielectric cables. The manufacturer has discontinued this cable but there is a good chance that the distributors have some on their shelves. With this low loss there is very little difference in the operation of this cable as a resonant line when compared to an open wire line, as you will note from perusal of figs. 4 and 5.

Of course, RG-17/U will also perform very well because it has less than half the loss of RG-8/U. It is difficult to install because of the great weight but many amateurs find means to overcome this type of disadvantage.

For those who are still not satisfied with the loss introduced by the Transmatch and have only an XYL with a motorized can opener there is one way to right the wrong that has been done. Design and build a linear amplifier using the wide impedance coupling circuit circa 1934. ■

antennas

BY WILLIAM I. ORR,* W6SAI

PENDERGAST opened the door of the shack. A scimitar of cold air slashed across his face and a flurry of snow sifted into the room. He closed the door hurriedly and said, "It's a cold night on the moor! Glad I don't have to shinny up a tower to work on an antenna tonight." Sensing no reply, he looked over at me and noted, "Still digging through the mail? Anything interesting?"

I dropped the pile of mail into my lap. "Never underestimate the ingenuity of a radio amateur," I replied. "Lots of hams are interested in the so-called "invisible" antennas because they have problems getting a sky-wire in the air." I paused, and pulled a letter out of the pile.

"Here's a great letter from John Milford, DA1JM. He's at a military base in Germany. Listen to his problem and how he solved it . . . 'I live on base and the houses are nearly identical on each and every base in Germany. They are 3 or 4 stories high, with either a flat or peaked roof. Until recently, we had a flat roof with a 30 foot tower atop it. The tower was capped off with a 2 element Quad built from the data in your "Cubical Quad Antennas" handbook[1].

'The flat roof is being replaced with a peaked roof, because of snow loading, I guess, and the antenna had to come down. And it can't go back up, because Uncle Sam doesn't want any antennas sticking out of the new roofs. All the roofs in the U.S. bases are being replaced with new, peaked roofs! Worse, still, the new roofs are all-metal construction, eliminating the possibility of an antenna under the roof.

'To get around this problem, I put up a vertical dipole on the side of the building, with a reflector. A simple two element beam, held to the vertical side of the wood building by small standoff insulators! In order to disguise the antenna, insulated wire was used with the same color jacket as the building color. A balun was used on the driven element and I painted it the same color as the building. The coax was run perpendicular to the driven element, half the distance to the reflector, and then straight down to the shack window. An old military rule of camouflage is that in a jungle or wooded area curved lines are best hidden, but in the open straight lines draw least attention! The finished antenna was well disguised and would be unnoticed if you did not know it was there.

'The beam worked so well I added 10 and 15 meter elements in a V-formation, at about 150 degrees to the 20 meter elements (fig. 1).'

"Pretty clever," said Pendergast. "Does DA1-JM say how the beam works out?"

I continued reading, "The antenna works well, though not as well as the Quad atop the tower. It seems to have good forward gain and a front-to-back ratio of about 15 db. The s.w.r. is quite low on all bands, running about 1.3 at resonance."

"Well," said Pendergast, "That proves it is pretty hard to keep a sharp ham off the air."

"Correct," I replied. "And here's a novel antenna scheme from Bob, WA2PCL. He can't put up a ham antenna, either, but all the apartments in his area have wash lines running out to poles in the back yard. Silly, isn't it? A wash line is OK, but a ham antenna on the roof is *verboten!*

"So Bob made the wash line into an antenna

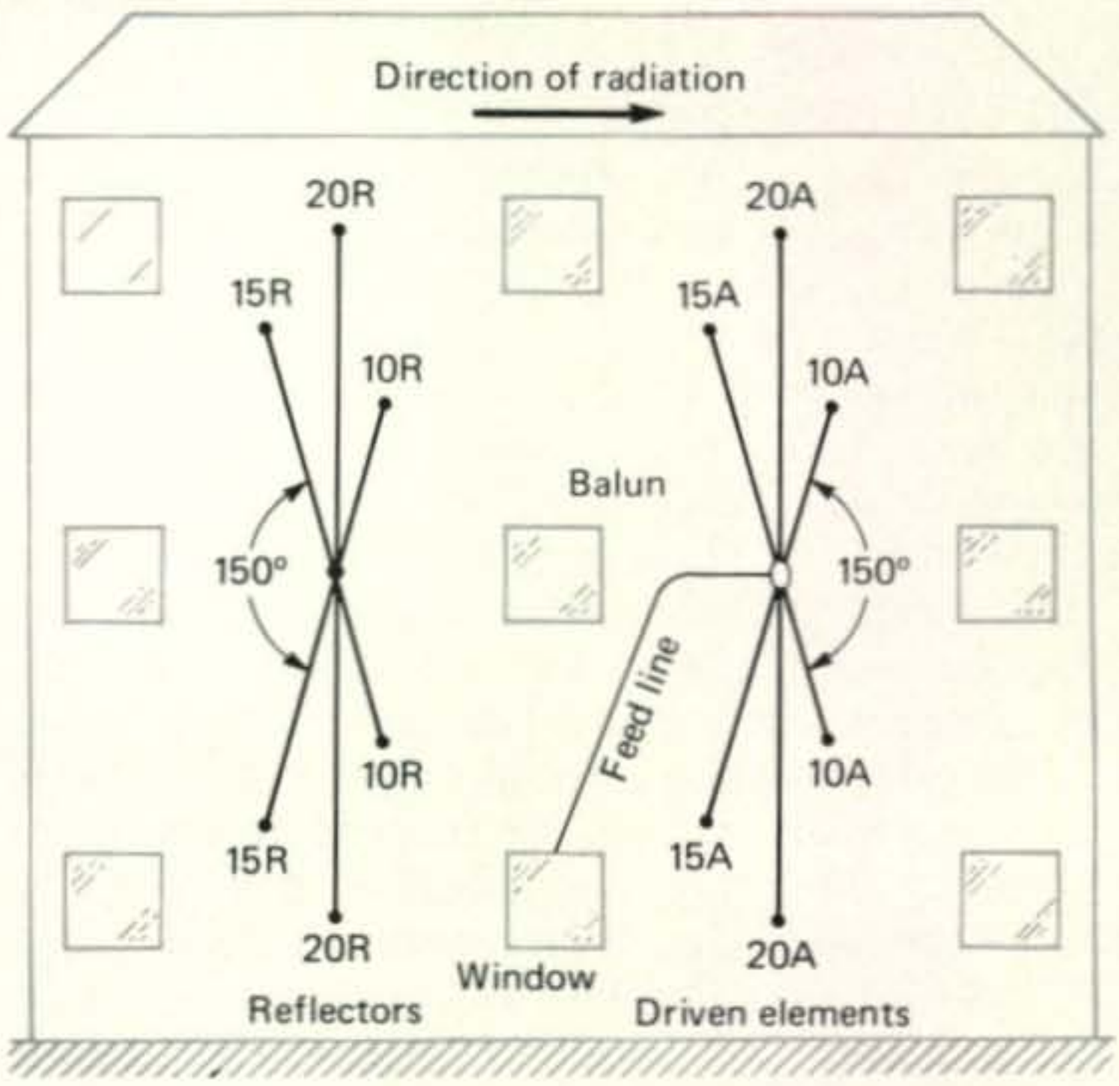


Fig. 1—DA1JM's "invisible" beam antenna in a vertical position on the wall of a 3 story wood frame apartment building. Beam dimensions are normal. The multiple reflectors are connected at the mid-point. The elements are constructed of insulated wire, painted to match the building and are held in position with small standoff insulators. The coaxial line is brought in a window. The beam is only one-inch away from the wood siding.

*48 Campbell Lane, Menlo Park, CA 94025.

[1] "All About Cubical Quad Antennas," Orr, Radio Publications, Wilton, Conn. 06897 ($3.95 plus 25¢ postage).

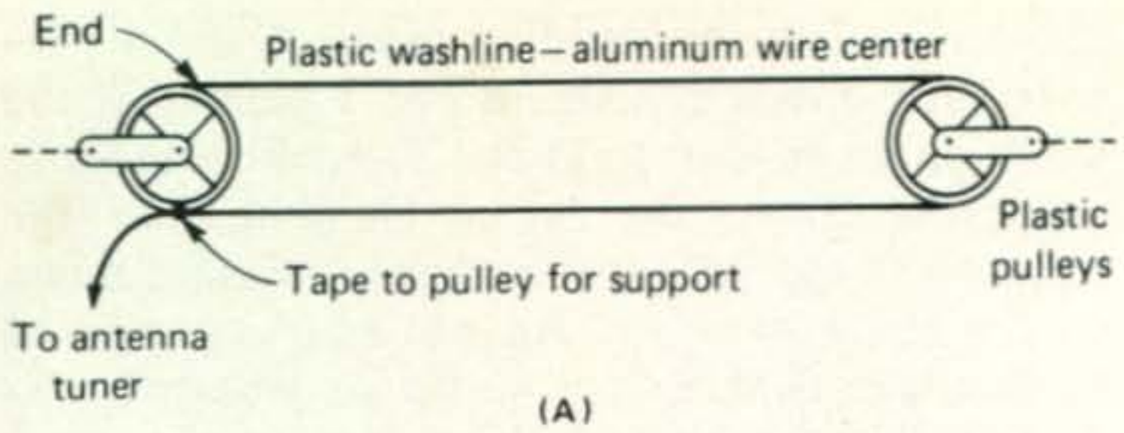


Fig. 2—WA2PCL's antenna is a washout! (A) Long wire antenna running back and forth between two plastic pulleys resembles a clothes line. End-fed antenna tuner is used in conjunction with a radial ground wire in the shack. (B) Dipole antenna with coaxial feed. Outer conductor of coaxial line should connect to left-hand side of dipole. Coaxial line is wrapped around ferrite core (L_1) to provide r.f. choke to suppress line currents. Choke consists of 3 turns of coaxial line passed through Indiana General CF-117 ferrite toroid, making a coil 4 inches in diameter for RG-58/U line. For data on ferrite, write Indiana General Corp., Crow Mills Rd., Keasby, NJ 08832. Core is Q-1 material, 1.875" diameter.

(fig. 2). He's tried a dipole and also an end-fed antenna, with a simple antenna tuner. Both ideas work out well and he's on the air."

"Not bad," said Pendergast. "I remember in New York City, there were big areas of 4 story apartments with clothes lines draped all over the rear yard. No reason why one of them wouldn't do double duty."

"Well, K4MD takes the prize," I replied. "He's stuck with an antenna problem, and one day he heard a ham in Pennsylvania describe his antenna. The fellow was living in an apartment house which prohibited the erection of *any* antennas. So he connected his antenna tuner to the aluminum window frame of his room and used that for an antenna.

"K4MD tried this out. He ran a piece of wire about 2 feet long from his rig to the aluminum window and used a quarter-wave ground radial in the shack, running along the floor. He used the window frame antenna on 40 meters.

"K4MD had an end-fed wire outside to compare the window antenna against, and found out it was about one S point weaker than the end-fed wire. He used it on some schedules and it worked fine. Admittedly, the window frame antenna is no DX antenna, but it does work and would be a boon to a cliff dweller who can't erect an outside antenna. Too bad we don't know who the Pennsylvania ham is who gave the idea to K4MD."

Pendergast scratched his head. "Glad I don't have antenna problems," he muttered.

"Sometimes you can't help yourself," I replied. "Here's a great letter from W9IZ with a report on an attic antenna. Some years ago Bill put up a 2 element beam on a tower. He moved about a mile, and took down the beam. Before he got it up again, his daughter moved to Boston and he wanted to work a phone patch with her.

"Since it was the dead of winter, he didn't want to put the old tower up, so Bill put his 2 element beam up in the attic of his home. This was about 25 feet high, I imagine.

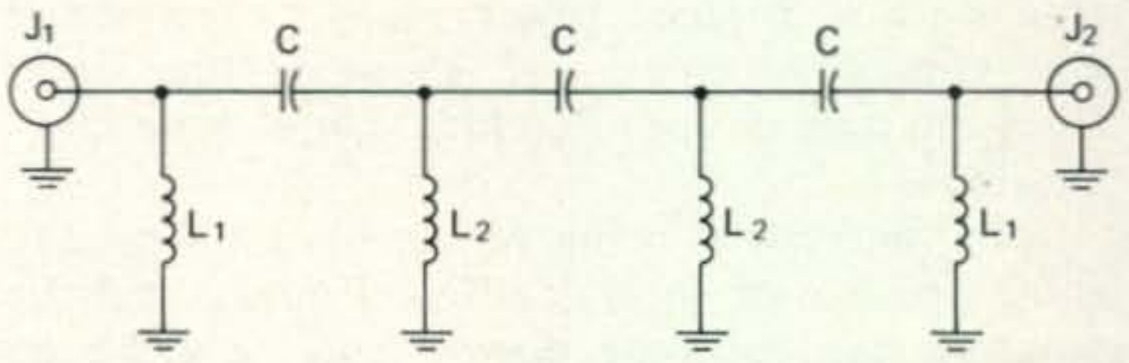
"Bill says, 'I cut the beam up into 4 or 5 pieces, maneuvered it up into the attic through a closet ceiling access cut-out, reassembled it and—with a few pieces of 1 × 2 wood—hung it on the rafters. I then took it all down and reversed the elements and put it back again, having found I had aimed it at California instead of Massachusetts!

'A word of caution! When installing an attic antenna, *do not* grab hold of a rafter and a wasp nest at the same time. This could cause one to step through a bedroom ceiling, incurring the displeasure of the XYL, etc.

'Since I had used the same beam before, I had somewhat of an idea of what to expect in the way of results. It really beams! And I've been using it for seven years, and have never bothered to put the old tower up again!' "

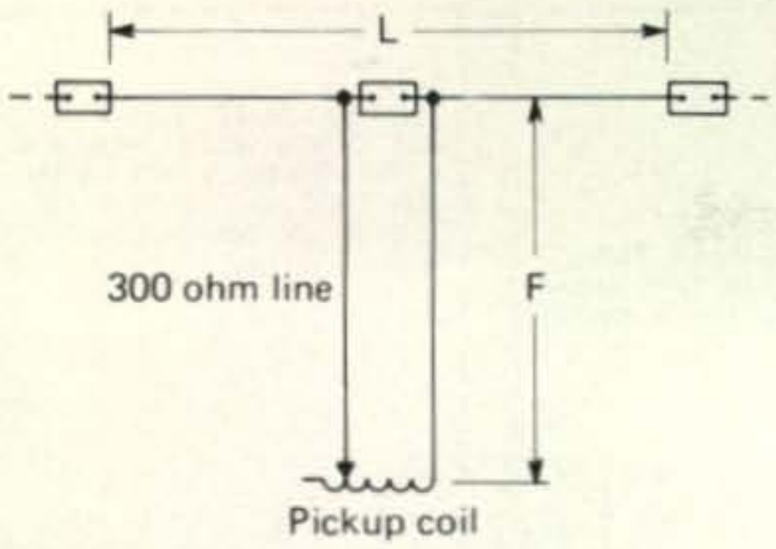
"That's really great," said Pendergast. I always wondered what snow would do when an indoor antenna was used."

"I once read an article about the hams at the



Band	80	40	20	15	10
L_1 (μH)	3.2	1.6	0.8	0.42	0.325
L_2 (μH)	1.6	0.8	0.4	0.21	0.17
C (pf)	600	300	150	80	62
f_{CO} (mHz)	2.5	5.0	10.0	18.0	25.0

Fig. 3—Low-pass filters for receiver protection. Each filter protects from signals lower in frequency than the designated band. Capacitors are silver mica, and inductors may be high-Q receiving type coils with movable powdered iron slug. Filter is built in aluminum box with coils arranged for minimum coupling between them.



Antenna length, L	136	275.5	67	103
Feeder length, F	66	99	65	82.5
Bands	80–40–20	160 thru 20	40–20–10	80–40–20
Nominal input impedance	1200Ω	1200Ω except 75Ω on 40M	75Ω = 40M 1200Ω = 20, 10M	1200Ω

Fig. 4—Original Collins "multiband" antenna, the grandfather of the modern G5RV antenna. The antenna is center-fed, with flat-top and feeder length chosen to provide either a 1200 or 75 ohm termination at the transmitter on various bands. The 300 ohm line was made of aluminum tubing. Antenna was described in the 1937 issue of the *Radio Handbook* as well as the ARRL *Handbook*. Made with modern, open-wire 300 ohm line, and used with an antenna tuner, the Collins antenna serves as a good multiband antenna today. 300 ohm ribbon line may be used for low power, if feeders are cut to 82 percent of lengths given in table.

Antarctic bases who laid their antennas right on the snow," I replied. "It seems to be a good insulator."

Pendergast looked out of the shack window. The snow, which had been falling steadily, had now stopped, and there were only small flurries in a clearing sky. He sighed.

"It may seem silly at this time of year to think of Field Day", he said, "But I'm going to try to get things organized early this year so it won't be a last minute panic. One of the things that would help, I think, is a set of low pass filters for each band. When you go multi-operator, a real problem is receiver overload, especially from a nearby transmitter on a lower band. Have any ideas?"

"A simple low pass filter may help," I replied. "For example, a design like this, built into a small aluminum box would attenuate low frequency signals, provided the signals did not sneak around the filter and get directly into the receiver (fig. 3). For example, the 80 meter filter attenuates all signals below 2.5 mHz, which includes the 160 meter band. The 40 meter filter cuts off at 5 mHz, knocking out the 80 and 160 meter bands. The 20 meter filter cuts off at 10 mHz, knocking out the 40, 80 and 160 meter bands, and so on. They can be built using little, high-Q coils and will fit in a very small box."

"Thank you," said Pendergast. "I'll copy the information in my little black book." He paused. "Before I push off into the snow and sleet, why don't we have a little discussion about the G5RV antenna. I work a lot of Aussies and G's and many of them use the G5RV, but they don't tell what it is on their QSL card. Do *you* know what a G5RV antenna is?"

"Well, I think so," I replied. "Basically, it is a center-fed, multi-band antenna. Sometimes it uses an antenna tuner, and sometimes not. If my memory is correct, this design was first publicized by Collins Radio Company in 1937 as the 'Collins Multiband Antenna' (fig. 4). The original description was in the 1937 ARRL *Handbook*, and also the 1937 *Radio Handbook*. Antenna dimensions were chosen so that when a 300 ohm feedline was used, the impedance at the bottom end of the line was either a low, or high value (75 ohms or 1200 ohms, if my memory is correct). Then, either a series-tuned or parallel-tuned network was used to couple the antenna system to the transmitter.

"The original antenna was written up in the 1936 issue of the *Collins Signal* magazine, as an adjunct to the Collins 30FXB transmitter. The 300 ohm line was constructed of ¼-inch diameter aluminum tubes spaced 1½ inches, center-to-center.

"As you can see from the illustration, several lengths of flat-top and feeder were available, and the end of the feedline was either coupled to the tank coil of the transmitter via high voltage capacitors, or a tapped pickup coil was used.

"The G5RV antenna is the 103 foot version, shortened to 102 feet for some obscure reason. Either open-wire line, or 300 ohm ribbon line may be used (fig. 5). This information is from the RSGB *Radio Communication Handbook*, 4th edition—a darned good reference work, by the way.

"The G5RV antenna can also be used with a 75 ohm twin-lead feeder. In any event, it is a refined version of the original Collins antenna, transplanted to England."

Pendergast smiled. "It seems a lot of antennas are named after popular DX stations that use them. The VS1AA antenna is the old single-wire-fed antenna called the *Windom*. That, of course, is named after 'Windy,' W8GZ, who popularized it. And don't forget the popular W8JK beam, too." He began to tug on a heavy sweater and prepared to leave.

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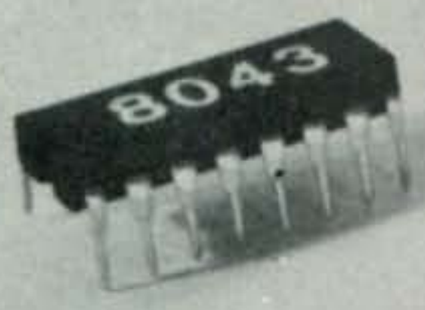

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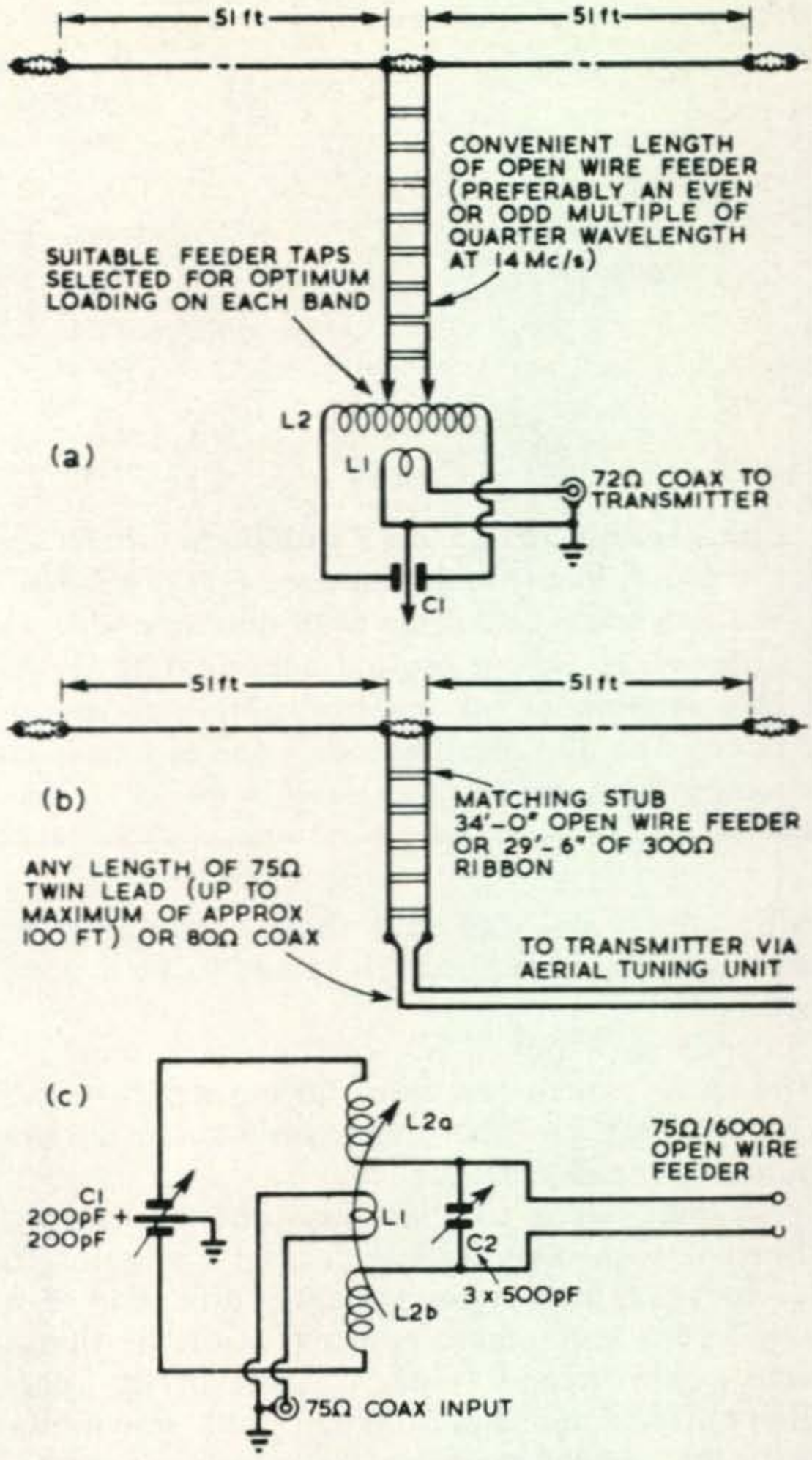

Fig. 5—Modern G5RV antenna, today's version of a 1937 idea. (A) Antenna tuner used with G5RV for multiband operation. (B) G5RV fed with matching stub and low impedance transmission line. (C) Universal antenna tuner. Impedance transformation ratio depends upon capacitance ratio of C_1 and C_2. Coils L_1 and L_2 are standard tuner coils. (Drawing courtesy of RSGB and *Radio Communication Handbook*).

"Season's Greetings and best wishes for 1975," he said with a smile. "What do you predict for amateur radio, antenna-wise, for the coming year?"

"Well, as Bob Booth, W3PS, says, 'It is difficult to prophetize, especially with respect to the future.' However, my guess is that there will be increased interest in log-periodic and log-periodic dipole arrays for the h.f. bands, increased interest in low frequency antennas for 80 and 160 meters—as the sunspot cycle drops—and more interest in moonbounce and moonbounce antennas. That guess covers a broad enough field so I can't be 100 percent wrong!"

Pendergast opened the door and a flurry of snow slid into the room. "Best Holiday Greetings," I said, "And may all your DX stations come back to you in 1975." ■

DX

BY JERRY HAGEN,* WA6GLD

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THE DX Department certainly hopes that 1974 has been a good year for all and that the DX fraternity enjoys a peaceful holiday season. We also wish to thank the enthusiastic DXers who contribute information for the DX column and help make the job of editing a very enjoyable one.

USA Bicentenary Special Calls

In the June DX COLUMN, we noted that the FCC had tentatively planned for a special prefix authorization for the USA Bicentenary in 1976. The FCC later asked that comments on a prefix scheme be suggested by amateurs. At this time we have received two possible as outlined below.

Rich, K1OME writes "A possible prefix procedure would be to give each U.S. Amateur the option of substituting a two-numbered figure instead of the normal call area number. This figure would correspond to the order in which a particular state entered the Union. Thus, a station in Delaware would substitute "Ø1" for the "3" and would be WØ1XXX, KØ1XXX and etc. Likewise a Pennsylvania station would be WØ2XXX and onward to KH5ØXXX for Hawaii, the 50th state. These would not all be special prefixes by current WPX criteria, but they seem more appropriate than K or W prefixes which are allocated for special event stations at present. This system seems to be acceptable to the FCC criteria of being optional and would not involve FCC paperwork."

Gary, W6NJU proposes a straight conversion of prefixes with the substitution of A for W, AA for WA, N for K and NB for WB. However, Gary notes that there seems to be some confusion over assigning of prefixes as A2, A4 and several other A prefixes have been authorized to other countries. (*Ed. note: we have written to the ITU asking about this and will report the results in a future column*).

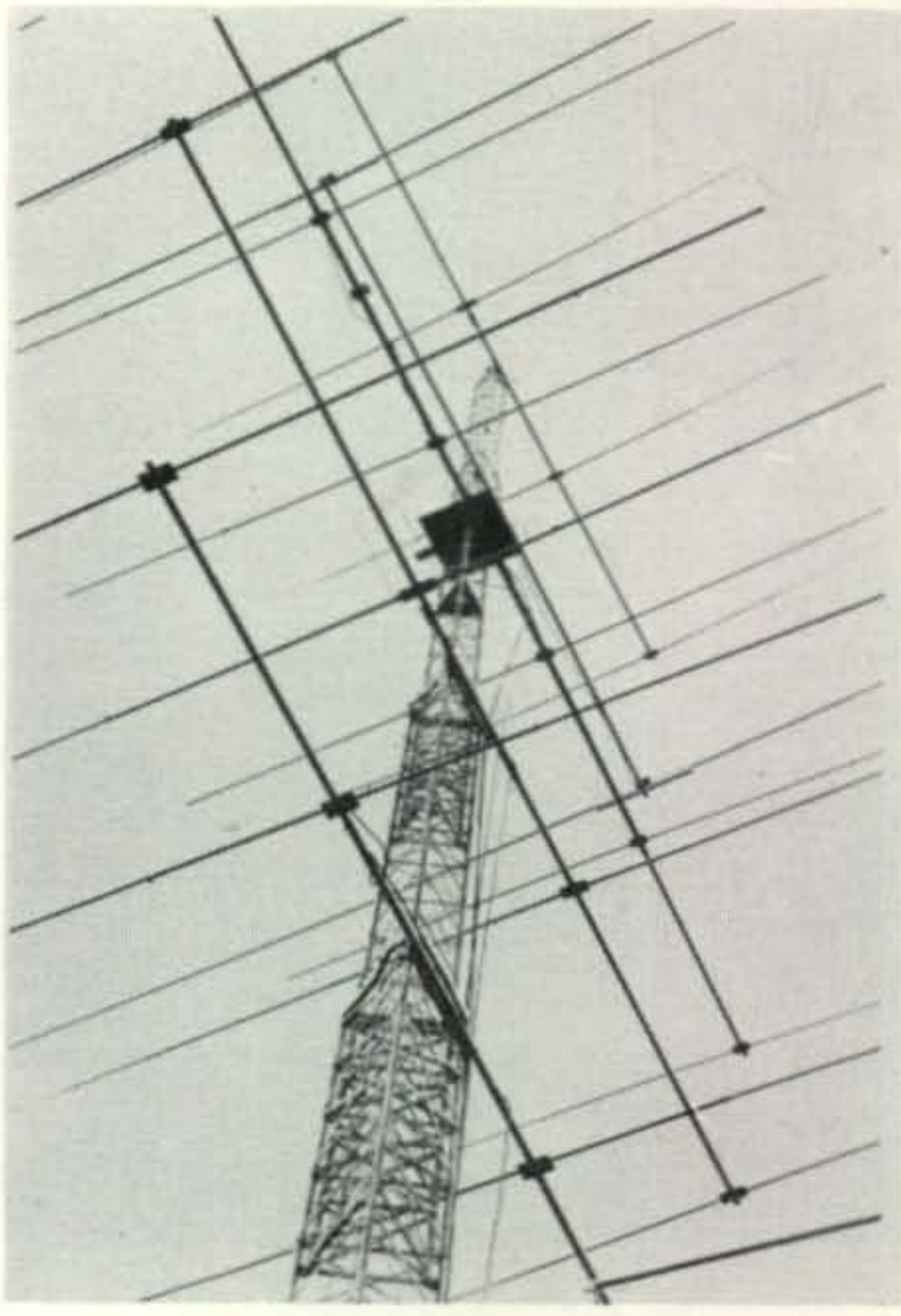
A second idea would be to have a series of blocks to chose from. This might be harder to understand but if specific blocks were used, one could still convert and relate to either W, WA, WB, etc. This would run something like W could use AA through AL, K could use NA through NL, WA could use NM through NS and WB could use NT through NZ. KH6 and KL7 would convert to KHØ and KLØ. Others such as KB6 and KP4 could also convert to Ø. Thus, W6NJU would have the choice of becoming AA6NJU, AB6NJU, AC6NJU. Picking prefixes in that block would always relate back that this was W6NJU.

*P.O. Box 1271, Covina, CA 91722

Here And There In The World Of DX

We received several nice notes from amateurs going on DXpeditions during the spring and summer of this year. Some of their comments are recalled below.

Paul, WA3IJR and Glenn, WAØVPK made a five-day trip to Gibraltar and signed ZB2WY and ZB2WZ from the east side of the "Rock". They made over 1300 QSO's, however, only



Ready for a contest? W9IY uses this impressive array which includes stacked 20 meter yagi's and yagi's for 40, 15 and 10 meters.

WPX HONOR ROLL

The WPX Honor Roll is based on confirmed current prefixes which are submitted by separate application in strict conformance with the CQ Master Prefix List. Scores are based on the current prefix total, regardless of an operators all-time prefix total.

Mixed

W4LRN 1375	DJ7CX 1004	I6SF 893	WAØKDI 824	K8UDJ 750
VE3GCO 1142	W4BQY 1002	W4WSF 877	SM7TV 822	CT1LN 749
WA6MWG 1120	WB2FMK 980	DL1CF 872	W6NJU 811	WA5LOB 749
F9RM 1100	ON4QX 975	K2AAC 863	W9WHM 811	PY4AP 735
W8LY 1082	W4IC 950	K6SDR 862	IØJX 803	KØBLT 733
W4CRW 1076	PAØSNG 943	W4BYU 859	WA5VDH 789	WA6EPQ 713
W3PVZ 1062	DL1MD 940	WØAUB 856	W3YHR 777	K6ZDL 708
W6TCQ 1056	W9FD 938	YU2DX 855	JA1AG 765	PAØVB 706
W3GJY 1052	K1SHN 934	WA2EAH 850	WA6JVD 763	W9ZTD 700
W8ROG 1051	WB4KZG 930	G3DO 849	WB4SIJ 755	WAØCPX 693
W2NUT 1025	YU1AG 928	W6ISQ 847	K2ZRO 751	WA6TAX 655

C.W.

W8LY 1067	W2AIW 813	VO1AW 742	I6SF 702	K6ZDL 609
W8KPL 1003	VK3AHQ 809	WA6JVD 741	W4IC 700	VE4OX 600
DL1QT 900	G2GM 785	YU1AG 741	OK2DB 693	OK2QX 600
W2HO 885	DJ7CX 782	W3ARK 739	W6ISQ 685	
WB2FMK 870	W4BYU 768	K2AAC 726	SM5BNX 652	
W9FD 870	K7ABV 767	WA6MWG 719	K2ZRO 635	
ON4QX 851	K1SHN 746	W6TCQ 707	K1LWI 629	

SSB

W4NJF 1100	WA6MWG 877	IT9TJ 806	OE2EGL 730	WA6TAX 665
F9RM 1047	ZL3NS 874	I4ZSQ 801	W6RKP 725	W2EHB 659
IØAMU 957	I8KDB 873	W4IC 800	W6YMV 720	WB4SIJ 652
DL9OH 932	WØYDB 869	I8YRK 766	OK1MP 715	WB4KZG 650
CT1PK 930	W6TCQ 860	G3DO 765	YU1AG 710	CR7IK 613
W9DWQ 917	DL1MD 858	K1SHN 753	WB6DXU 708	I4LCK 608
HP1JC 903	F2MO 835	W3YHR 750	WB2NYM 702	WA5VDH 607
IØZV 886	PAØSNG 824	WA5LOB 747	WA2EAH 700	
K2POA 883	W3DJZ 818	PY3BXW 734	CX2CN 679	

six W/K stations were worked due to the 1300 foot rock to the west of the operating QTH. The fellows hope to return to ZB2 in the spring and operate from the west side during the ARRL DX Test if a suitable hotel and permission to put antennas on the roof can be obtained. The photo of the island leaves no doubt as to why it was virtually impossible to work the USA!

Dan, WA9FZQ writes, "During a visit to West Africa this past spring I had the pleasure of being the house guest of Jacques, 5U7BB, and Elyane, 5U7YK, in Niamey, Niger. Jacques was kind enough to lend me his station and, from May 23 through May 26 (1974) I promised all those I contacted that I would QSL 100% and that cards should be sent to my home call, WA9FZQ. I cannot confirm contacts for days other than those of my operation, however, I have been inundated by QSL's running the gamut of Jacques' entire two-year stay in Niamey!

In spite of the 110° heat, I attempted to give a rare country to as many hams as possible. I will QSL 100% all contacts made during my stay at 5U7BB. Naturally, I ask that stations send along return postage if they want a direct reply."

At the California DX Convention, VK3JW accepts a trophy from W6AOA for his effort in putting Mellish Reef on the DXCC list. (Photo via West Coast DX Bulletin)

John, SM7CRW. His business card reads, "Used cars, land, whiskey, nails, fly swatters, racing forms and bongos." What, no ham radio, John?

The WPX Program

Mixed

455.....W9LJL
456.....WB8LVA
457.....OK2BOL
458.....WA8TFJ

C.W.

1352.....PA0AAC
1353.....W3OJS
1354.....JA2IU
1355.....F2VO
1356.....JA2EG
1357.....WA2ZWH
1358.....DL1YK
1359.....WA8TFJ
1360.....LA7FJ

S.S.B.

817.....I3GRX
818.....WA8TFJ

WPNX

73.....WN4CTA
74.....WN8TFJ

VPX

79.....VU-0020

Endorsements

Mixed: WA6MWG, VE3GCO-1100, W4BQY, W4CRW, W3GJY-1050, W4WSF-1000, K1SHN-950, I6SF-900, WA2EAH-850, K4CIA-800, W2MB-750, K7NHG, WA6TAX-700, HI8LC-600, WA2DHF, K4ZYU, WA8-TFJ, OK2BOL-500.
C.W.: WB2FMK-900, G2GM-850, WA6JVD, WB4SIJ, K1SHN-750, I6SF-700, W3URE-650, WA9UES-600, W6CLM-500, K9DDA, G3FVC, WA1JMP, JA2IU, LA7FJ-400, PA0AAC, JA2EG, WA8TFJ-350.
S.S.B. 18AA, W0YDB-850, IT9JT-800, WA8TFJ-350.
WPNX: WN1ORL-150.
VPX: W4-10640-500, OE1-10117-400.
160 Meters: OK2BOL
80 Meters: OK2BOL
40 Meters: W4WSF
20 Meters: WA2EAH
Asia: JA1VE
Europe: W4-10646
North America: W4-10646
Oceania: W0-6437, JA1VE
South America: WA2EAH
Complete rules for WPX, WPNX and VPX may be found on pg. 67 of the February 1972 issue of *CQ*. Application forms and reprints of the rules may be obtained by sending a business size, self-addressed stamped envelope to WPX Award Manager, P.O. Box 1271, Covina, CA 91722.

Both Jacques and Elyane have now left Niamey. Cards for them, 5U7BB and 5U7YK, should be sent to F6AJW.

The *Long Island DX Association Bulletin* printed the following letter from Diane, VQ9-DC about the September DXpedition to Desroches. "When my OM John, VQ9MI, couldn't go, I offered my services to make the rough sea journey aboard the racing yacht *Stormy*—the sleek boat that won the Cape-to-Rio race two years ago. With a promise of good propagation for 10 days, I purchased stores while Bill, VQ9BP, Dick, VQ9D and Ron, VQ9M loaded all their gear plus gas, generators, tools and spares, together with personal and photographic kits. We set sail on Saturday afternoon September 7th, at 1300Z and thankfully arrived in calmer seas the following morning with a first light view of Desroches; 800 acres of beautiful, peaceful, remote island—the shorefront clothed with cedars, mangroves and tall palms, and the air filled with thousands of Red Cardinals.

A TH3 can come down faster than it goes up! That was the only incident to mar an otherwise routine setup of our stations. Even with a right-angle bend in one if its elements (note

The pretty DXer is Elyane, 5U7YK who has returned to France after two years of operating from Niamey. (Tnx WA9FZQ)

to Hy-Gain) it worked like a treat! Within minutes of my KW2000E getting warm, I was in contact with 5Z4NH. His "Wow" when I gave the /D, made our first day! Four days and sixty countries later, my rig went on the blink and from then on I was 2nd operator at the other rigs on 7, 14, 21 and 28 mHz, finally winding up with 75 countries.

We were all very much impressed by the standard of operating of the calling stations. Their courtesy and standing by when requested were appreciated by us weary ops. The long queues increased as the nights progressed but we would have been disappointed if it had been otherwise. I was delighted to work into the YL-ISSB-ers system with Mary-Ann, WA3HUP ably pushing through as many callers as possible in the shortest amount of time and it was nice to have a contact with Harvey, W2IYX, amongst many other friends. By the way, we expect our special QSL cards from a Stateside printer in about six weeks—so don't despair, you will all collect one!

Lots of work but lots of fun, too. Like huge breakfasts cooked outside in the dark, smokey kitchen. With two wood open-fires going,

The QTH of ZB2WY and ZB2WZ was in this hotel . . . no wonder they had trouble working the US!

On the left is Paul, ZB2WY (WA3IJR) and on the right is Glen, WAØVPK during their DXpedition to Gibraltar.

smoke everywhere and the temperature at 90°F, it seemed difficult to produce true American meals like Mom used to make—especially for a Limey. But we survived and they ate everything I put in front of them, plenty of freshly caught fish, sausage, Chinese noodles and champagne. Bill adopted a puppy (or vice versa) which he promptly named "CQ" and which delighted us by joining us for meals and playfully chewing at our bare feet. We got in a little swimming, lots of photography and snorkelling, and Ron speared a very fine (delicious) lobster.

The two weeks flew by and again we were sailing (?) in very, very rough waters whipped by a 30-knot wind. For 15½ hours the only safe place was in one's bunk and it was a bleary-eyed, wet quartet that disembarked on the *Seychelles* at 0400Z on September 21st, with a single thought: not only was it worth every minute, but we would do it again.

ARRL DX Advisory Committee

The ARRL DX Advisory Committee has released the following questions for comment by DXers. Question number 5 appears to be the most controversial and the summary of replies should be most interesting!

1. Should home-station DXCC credit be given automatically (no actual contact need be made with the home station) to the activator of a DXpedition for the country visited?

2. Should check of QSL's for DXCC endorsements (for country totals of 120 through 290) be performed by IARU Societies?

3. Should a c.w.-only DXCC Award be established?

4. Should contacts made by the holders of special "ITU" calls be creditable towards their "regular-call" DXCC Award?

5. Should a country in which there has been no amateur radio activity for a period of ten years be considered (for purpose of DXCC Honor Roll) as are deleted countries? (Any subsequent activity would reinstate past credits. This to be retroactive to all current listings on the ARRL Countries list.)

6. Should yearly listing of all holders of the 5BDXCC Award appear in *QST?*

7. Should DXCC Rule 9 be changed to read "Contacts may be made from within the continental boundaries of any country"?

8. Should DXCC Rule 9 be changed to read "All stations must be contacted from a fixed location for which the original DXCC Certificate was issued? One exception is allowed to this rule: Where the station moves within the original Call Area or to an adjacent Call Area, or from one country to another, all contacts must be made from within a radius of 500 miles of the initial location.

If you have any comments on any of these questions, write the DXAC via ARRL HQ. Whatever is received at HQ will be copied and sent off to all members. ■

This is Jerry, 4W1GM, of Sanaa, Yemen, who previously signed SVØWUU. He looks for W/K's weekends at 1800Z on 14.222 mHz. Photo via W3HNK, Jerry's QSL Manager.

The WAZ Program

S.S.B. WAZ

1225.....JA4BBN
1226.....WA1JMP
1227.....W8EX
1228.....W3DBT

C.W.—Phone WAZ

3756.....HI8LC
3757.....I8LEL
3758.....W1LQQ
3759.....HB9ASK
3760.....DJ8CR
3761.....W7TE
3762.....W6HJ
3763.....W5JLU
3764.....YU2RIO
3765.....YU2CAW
3766.....YU2RAZ
3767.....OZ1W
3768.....DK6ML
3769.....DJ8JP

Phone WAZ

500.....WA9SLD

Complete rules for the Single Band WAZ Program are shown on pgs. 57-58 of the December, 1972 issue of *CQ*. Complete rules for regular WAZ may be found on pgs. 64-66 of the June, 1970 issue. Application blanks and reprints of the rules for WAZ awards may be obtained by sending a self-addressed, stamped envelope to the Assistant DX Editor, P.O. Box 205, Winter Haven, FL 33880.

CALL 516-883-6223
FOR DIAL-A-PROP

Propagation

BY GEORGE JACOBS,* W3ASK

ALTHOUGH solar activity continues to decline slowly, winter propagation means higher daytime frequencies and improved conditions on *10, 15* and *20* meters during the hours of daylight. It also means longer hours of darkness and considerably lower static levels, which should result in improved DX conditions on *40, 80* and *160* meters during the hours of *darkness*. All-in-all, it should be a relatively good month for DX propagation, whatever h.f. band you operate on.

Ten meters should open to several areas of the world when conditions are normal. Signals should peak towards Europe, Africa and the east before Noon; towards South America during the early afternoon and towards the Pacific and Australasia during the late afternoon.

Openings on *15 meters* should follow a similar pattern, but this band should open more often than *10 meters*, stay open longer, and with stronger signal levels.

Expect *20 meter* openings in almost all DX directions for several hours after sunrise. Signals should peak toward Europe and the east during the early afternoon; towards Africa an hour or two later; towards South America during the late afternoon and into the early evening; towards the Far East, the Pacific area and Australasia during the early evening and towards Antarctica during the evening almost to Midnight.

Forty meters should being to open for DX during the late afternoon, with the first signals coming from Europe. After sundown the band should open to Africa and to South America. Signals from the Pacific area, the Far East and Australasia should peak just before sunrise, but the band may be open for several hours earlier.

Fairly good DX is also expected on *80 meters* between sundown and sunrise. Signals from Europe, Africa and the east should peak before Midnight; signals from South America should be in for most of the hours of darkness; and signals from Australasia and the Pacific area should peak just before sunrise.

This should be quite an active month for *160* meter DXers. The ARRL Annual 160 Meter DX Test will be held on Dec. 7 and 8, and the 42nd Annual Trans-Atlantic DX Tests will be held between 0500 and 0730 GMT on Dec. 22. It looks like nature might cooperate with relatively good DX conditions for this band. Check for openings towards Europe and the east beginning about 8 P.M. and until 2 A.M. in EST time zone; 1 A.M. in CST; Midnight in MST and 11 P.M. *in* PST. Some openings towards the south, especially to the Caribbean area, should be possible from about 10 P.M. to 2 A.M. in all time zones. Openings towards the Pacific and Australasia favor west coast stations, but it's worth looking for them in all time zones between 4 A.M. and sunrise. Remember that DX conditions tend to peak on *160* meters about the time that the sun *rises* at the *easternmost* terminal of a DX path.

For *short-skip* openings during December of less than 250 miles, try *80* meters during the day and *160* meters at night. For openings between 250 and 750 miles, best bet is *40* meters during the day and *80* at night. Between 750 and 1300 miles try *20* during the day, *40* during the early evening and *80* later in the evening and until sunrise. For openings between 1300 and 2300 miles, *20* looks best during the day, but check *15* during the afternoon. Try *40* during the evening to about Midnight and *80* for the remainder of the night to sunrise. An occasional short-skip opening between approximately 1500 and 2300 miles may be possible on *10 meters* during the afternoon.

*11307 Clara St., Silver Spring, MD 20902.

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For December, 1974

Propagation Index .....(4)		(3)	(2)	(1)
Date	*November*			
Above Normal: 3, 6, 29-31	A	A-B	B-C	C
Normal: 1-2, 4-5, 7, 14-17, 21-24, 26-28	A-B	B-C	C-D	D-E
Below Normal: 8-10, 13, 18-20, 25	B-C	C-D	D-E	E
Disturbed: 11-12	C-D	D	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals.

B—Good opening, moderately strong signals with little fading or noise.

C—Fair opening, signals between moderately strong and weak, with some fading and noise.

D—Poor opening, signals weak with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.
2. With the *propagation index*, use the above table to find the expected signal quality associated with the particular opening for any day of the month. For example, all openings shown in the Charts with a *propagation* index of (3) will be fair-to-good on Dec. 1-2, (B-C), good-to-excellent on Dec. 4 (A-B) and poor on Dec. 11 (D), etc.

For updated information dial Area Code 516-883-6223 for DIAL-A-PROP, or subscribe to weekly MAIL-A-PROP, P.O. Box 86, Northport, NY 11768.

How To Use The DX Propagation Charts

1. Use Chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts. An * indicates 80 Meter openings. Openings on 160 meters are likely to occur during those times when 80 meter openings are shown with a *propagation index* of (2), or higher.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this Propagation column for the actual *dates* on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

4. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M., 13 is 1 P.M., etc. Appropriate *standard* time is used, *not* GMT. To convert to GMT, add to the times shown in the appropriate Chart 8 hours in the PST Zone, 7 in the MST Zone, 6 in the CST Zone and 5 in the EST Zone. For example 14 in Washington, D.C. is 19 GMT and 20 in Los Angeles is 04 GMT, etc.

5. The charts are based upon a transmitter power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level; for each 10 db loss, it will lower by one level.

6. Propagation data, contained in the Charts has been prepared from basic data published by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

Sunspot Cycle

The Swiss Federal Observatory at Zurich reports a mean sunspot number of 42 for September, 1974. This results in a smoothed sunspot number of 36 centered on March, 1974.

A smoothed sunspot number of 28 is forecast for December, as the solar cycle continues to decline towards a minimum now estimated to be about two years away.

V.H.F. Ionospheric Openings

Quite a bit of meteor activity is expected during the month. *Geminids,* a major meteor shower, should begin on December 13 and last for about three days. Maximum intensity is expected at approximately 4 A.M. EST on December 14, with a meteor rate of about one a minute. This should permit fairly good meteor-type openings on both *6* and *2* meters. A second, but somewhat less intense shower period is expected later in the month. Called *Ursids,* it should take place on December 21 and 22, peaking at about 8 P.M. on the 22nd. A meteor rate of about 15 per hour is expected at its peak.

A secondary seasonal peak in sporadic-E propagation usually occurs during December (the major peak takes place during the summer months). This should result in some fairly good short-skip type openings on *6* meters, between distances of approximately 800 and 1400 miles. Conditions are most likely to peak during the early evening, but openings can occur at other times as well.

Some auroral-type v.h.f. ionospheric openings are also likely to occur during December, especially when ionospheric conditions on the h.f. bands are below normal or disturbed. Be sure to check on December 11 and 12, and auroral activity may also occur on the 8-10, 13, 18-20 and 25th of December.

160 Meter Annual DX Tests

W1BB informs us that the 42nd Annual TransAtlantic 160 Meter DX Tests will take place on Dec. 22, Jan. 12 and February 9, between 0500 and 0730 GMT. W/VE stations operate in the 1800-1807 kHz portion of the band while DX stations should operate in the 1825-1830 kHz portion. W/VE stations call "CQ FT DX" or "FT DX" for the first *three* minutes of each fifteen minute period starting on the hour. The remaining twelve minutes of each period are used for contacts or for CQ calls by DX stations.

This is not a contest, but a test period in which it is hoped to bring on the air as many stations as possible on both sides of the Atlantic, especially new stations that have not worked *160* meter DX before. W1BB expects that stations in as many as two dozen or more countries may be on during this year's test periods. If you're looking for DX activity on *160* meters, be sure to check into the test periods. With lower solar activity, this may be the best year for *160* meter DX since a decade ago.

Reports of QSOs made during the test periods should be sent for tabulation and propagation analysis to W1BB, Stewart S. Perry, 36 Pleasant St., Winthrop, Mass. 02152.

This month's column contains DX Propagation Charts valid through February 15, 1975. Short-Skip Propagation Charts for use during December appeared in last month's column.

The Editor of this column would like to take this opportunity to extend his warmest wishes to everyone, everywhere during this holiday season. 73, George, W3ASK

CQ'S DIAL-A-PROP

For the latest up to the minute propagation forecasts and special contest predictions call 516-883-6223 any time day or night for a recorded message on conditions.

December 15, 1974—February 15, 1975
Time Zone: EST (24-Hour Time)
EASTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	09-11 (1)	08-09 (1) 09-11 (3) 11-12 (2) 12-13 (1)	06-07 (1) 07-09 (4) 09-11 (3) 11-13 (4) 13-14 (3) 14-15 (2) 15-17 (1)	15-16 (1) 16-17 (2) 17-19 (3) 19-00 (4) 00-02 (2) 02-03 (3) 03-05 (1) 17-19 (1)* 19-20 (2)* 20-02 (3)* 02-03 (2)* 03-04 (1)
Northern Europe & European USSR	08-10 (1)	08-09 (1) 09-10 (2) 10-11 (1)	06-07 (1) 07-09 (3) 09-12 (2) 12-14 (1)	16-19 (1) 19-23 (2) 23-03 (1) 19-02 (1)*
Eastern Mediter-ranean & Middle East	08-10 (1)	08-09 (1) 09-10 (3) 10-11 (2) 11-12 (1)	06-09 (1) 09-10 (2) 10-13 (3) 13-15 (2) 15-17 (1)	18-20 (1) 20-22 (2) 22-00 (1) 20-23 (1)*
West Africa	09-11 (1) 11-13 (2) 13-15 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-14 (4) 14-15 (3) 15-16 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	18-22 (1) 22-00 (2) 00-03 (1) 03-04 (2) 00-02 (1)*
East & Central Africa	10-13 (1)	08-10 (1) 10-12 (2) 12-13 (3) 13-15 (2) 15-16 (1)	07-13 (1) 13-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	18-00 (1)
South Africa	09-12 (1)	08-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	07-09 (1) 12-14 (1) 14-15 (2) 15-17 (3) 17-18 (2) 18-20 (1)	18-19 (1) 19-21 (2) 21-00 (1) 19-22 (1)*
Central & South Asia	*Nil*	17-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 18-21 (1)	06-08 (1) 20-22 (1)
Southeast Asia	*Nil*	17-19 (1)	06-07 (1) 07-09 (2) 09-12 (1) 19-21 (1)	06-08 (1) 20-22 (1)
Far East	*Nil*	16-17 (1) 17-18 (2) 18-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-20 (2) 20-21 (1)	05-08 (1) 05-07 (1)*
South Pacific & New Zealand	13-17 (1)	11-14 (1) 14-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	03-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-20 (2) 20-22 (1)	01-02 (1) 02-04 (2) 04-07 (3) 07-08 (2) 08-09 (1) 04-05 (1)* 05-07 (2)* 07-08 (1)*
Australasia	15-17 (1)	11-16 (1) 16-18 (2) 18-19 (1)	06-07 (1) 07-10 (2) 10-14 (1) 14-16 (2) 16-18 (1) 18-20 (2) 20-22 (1)	03-05 (1) 05-07 (2) 07-09 (1) 05-08 (1)*
Central America & Northern Countries of South America	09-10 (1) 10-12 (2) 12-14 (1) 14-15 (2) 15-16 (1)	08-09 (1) 09-11 (3) 11-13 (2) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	06-07 (2) 07-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-18 (4) 18-19 (3) 19-20 (2) 20-22 (1) 22-00 (2) 00-06 (1)	17-18 (1) 18-19 (2) 19-21 (3) 21-04 (4) 04-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-22 (2)* 22-02 (3)* 02-04 (2)* 04-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	09-12 (1) 12-15 (2) 15-16 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-16 (4) 16-17 (3) 17-18 (1)	13-14 (1) 14-15 (2) 15-17 (3) 17-18 (4) 18-19 (3) 19-20 (2) 20-22 (1) 22-00 (2) 00-03 (1) 05-06 (1) 06-08 (2) 08-09 (1)	19-21 (1) 21-02 (2) 02-05 (1) 21-03 (1)*
McMurdo Sound, Antarctica	*Nil*	15-17 (1)	07-09 (1) 17-18 (1) 18-22 (2) 22-00 (1) 00-02 (2) 02-03 (1)	00-05 (1)

Time Zones: CST & MST (24-Hour Time)
CENTRAL USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	08-10 (1)	08-09 (1) 09-12 (2) 12-13 (1)	06-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-15 (1) 22-00 (1)	16-18 (1) 18-20 (2) 20-00 (1) 00-02 (2) 02-03 (1) 17-20 (1)* 20-01 (2)* 01-02 (1)*
Northern & Central Europe & European USSR	*Nil*	08-11 (1)	07-08 (1) 08-11 (2) 11-13 (1) 22-00 (1)	17-19 (1) 19-22 (2) 22-01 (1) 19-00 (1)*
Eastern Mediter-ranean & Middle East	*Nil*	08-11 (1)	06-09 (1) 09-14 (2) 14-15 (1) 22-00 (1)	18-20 (2) 20-22 (2) 22-23 (1) 20-22 (1)*
West Africa	09-10 (1) 10-12 (2) 12-13 (1)	07-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	06-11 (1) 11-13 (2) 13-16 (3) 16-17 (2) 17-19 (1) 22-01 (1)	18-21 (1) 21-23 (2) 23-01 (1) 19-22 (1)*
East & Central Africa	10-12 (1)	08-11 (1) 11-13 (2) 13-14 (1)	06-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	19-23 (1)
South Africa	09-10 (1) 10-12 (2) 12-13 (1)	08-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	07-13 (1) 13-15 (2) 15-17 (3) 17-18 (2) 18-19 (1) 23-01 (1)	18-19 (1) 19-21 (2) 21-23 (1)
Central & South Asia	*Nil*	18-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 18-19 (1) 19-21 (2) 21-22 (1)	06-08 (1) 19-21 (1)
Southeast Asia	*Nil*	17-19 (1)	07-08 (1) 08-10 (2) 10-12 (1) 16-18 (1) 18-20 (2) 20-22 (1)	04-07 (1)
Far East	16-18 (1)	16-17 (1) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 15-17 (1) 17-19 (2) 19-21 (1)	02-04 (1) 04-06 (2) 06-07 (1) 04-07 (1)*

*Indicates best time to listen for 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a forecast rating of (2), or higher.

[*Continued on page 71*]

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

*Dec.	7-8	TOPS C.W. Contest
*Dec.	6-8	ARRL 160 Meter Contest
*Dec.	7-8	Space Net VHF Contest
*Dec.	8-14	Hoosier Amateur Radio Week
*Dec.	14-15	Spanish C.W. Contest
Dec.	14-15	ARRL 10 Meter Contest
Dec.	22	Hungarian Contest
Dec.	29	Zip Code Contest
Jan.	4-5	ARRL VHF Sweepstakes
Jan.	8-9	YL DX C.W. Contest
Jan.	11-12	YU 80 Meter C.W. Contest
Jan.	11-12	DL QRP C.W. Contest
Jan.	18	RTTY Flash Contest
Jan.	**24-26**	**CQ WW 160 C.W. Contest**
Jan.	25-26	French C.W. Contest
Jan.	26	RTTY Flash Contest
Jan.	29-30	YL DX Phone Contest
Feb.	1-2	ARRL DX Phone Contest
Feb.	2	Two Meter RTTY Contest
Feb.	8-9	QCWA QSO Party
Feb.	15-16	ARRL DX C.W. Contest
Feb.	22-23	French Phone Contest
Feb.	22-24	Vermont QSO Party
Mar.	1-2	ARRL DX Phone Contest
Mar.	15-16	ARRL DX C.W. Contest
Mar.	**29-30**	**CQ WW WPX SSB Contest**
Apr.	26-27	WAEDC RTTY Contest
May	17-19	Michigan QSO Party

*Covered in last month's Calendar.

ARRL 10 Meter Contest

Starts: 1200 GMT Saturday, December 14
Ends: 2359 GMT Sunday, December 15

Last year's initial contest was a big success in spite of the low sunspot cycle, and should be well attended this year.

This is a worldwide activity in which DX stations can work other DX and not be limited to working W/K and VE only. The same station may be worked both on phone and c.w.

Exchange: Stations in the 50 US states and Canada send RS(T) and state or province. Others send RS(T) and a contact number starting with 001. KP4, KV4, KZ5, KC6 and etc. also use the contact number. Stations not land-based give their ITU Region.

Scoring: Each completed QSO is worth 2 points, 4 points if its with a Novice. The multiplier will consist of US states, VE call areas, ITU regions and DXCC countries worked. (except US and Canada)

Awards: Certificates to the highest scoring single operator in each ARRL section, VE call area and DX country. Multi-operator and Novice awards will be given if three or more entries in a section are received.

It is recommended you send a large s.a.s.e. to ARRL who will provide you with more details and appropriate contest forms.

Mailing deadline for logs is January 21st to: ARRL Communications Dept. 225 Main Street, Newington, Conn. 06111.

Hungarian Contest

Starts: 0000 GMT Sunday, December 22
Ends: 2400 GMT Sunday, December 22

This is a worldwide type contest with operation permitted on all bands, both phone and c.w. There are three categories, single operator, multi-operator and s.w.l.

Exchange: RS(T) and ITU Zone number.

Scoring: Contacts between stations on the same continent 1 point, on different continents 3 points. Contacts with Hungarians, HA/HG5 are worth 4 points, and 5 points if its with the special HA5 prefix. The multiplier is determined by number of ITU Zones worked.

Awards: Certificates to the top scoring stations in each category in each country. The world leaders in each of the three categories will receive the Budapest Plaque.

A summary sheet with the scoring and other necessary information, and a signed declaration is also requested.

Mailing deadline is January 15th to: BRAL Contest Committee, P.O. Box 214, Budapest 134, Hungary.

Christmas Zip-Code Contest

Starts: 0000 GMT Sunday, December 29
Ends: 2359 GMT Sunday, December 29

This is the second of a series of Zip-Code contests organized by the South Eastern Virginia Wireless Assoc. There are 3 each year, Labor Day, Christmas and Memorial Day.

The same station may be worked once per band and Mode. Phone and c.w. are separate and should be scored separately.

Exchange: RS(T), Zip-Code as it appears on station license, and state, province or country. (DX stations use 00050.)

Scoring: Based on the last two digits in the Zip-Code worked. (*i.e.*: 23518 is worth 18 points) Multiplier of one for each state worked, plus 1 for the first DX contact. (max. of 51) KH6 and KL7 are states but may be counted for the first DX contact.

Final Score: Total of all Zip points × the state plus DX multiplier.

*14 Sherwood Road, Stamford, Conn. 06905.

Frequencies: C.W.—60 kHz up from each band edge. Phone—3900, 7225, 14275, 21350, 28550. Novice—3710, 7110, 21110, 28110.

Awards: Highest score in each call area and overall winner, both phone and c.w. Also overall DX winner on each continent and for the top Novice.

Mailing deadline January 30th to: SEVWA Zip-Code Contest, P.O. Box 14411, Norfolk, Virginia 23518.

YL—DX to North America Contest

C.W.: Jan. 8-9 Phone: Jan. 29-30
Starts: 1800 GMT Wednesday
Ends: 1800 GMT Thursday

YL's on the North American continent, US states and Canadian provinces, will be working the DX YL's (inc. KH6 and KL7) in this one. Alaska however is limited to working the Eastern Canadian provinces and may not contact stations in VE5 thru VE8, but may work Hawaii. (*Gets rather complicated. Ed.*)

Phone and c.w. are separate contests and require separate logs. The same station may be worked on each band for QSO credit, net contacts are not permitted and only QSO's with other YL's are valid.

Exchange: QSO no., RS(T) and QTH. State for W/K, province for VE and country for DX.

Scoring: One point for each QSO. North American stations will count DX countries as their multiplier. DX stations, US states and VE provinces. There is a power multiplier of 1.25 if power input is 150 watts or less. (300 p.e.p. on s.s.b.)

Final Score: QSO points × multiplier × power multiplier if any.

Awards: Trophies to 1st place c.w. and phone winners, both DX and North America. Plaques to highest combined scores for both and certificates to second and third place winners.

Submit separate logs for each section and a signed declaration no later than February 6th. They must be received before Feb. 21st so overseas entries should use air mail.

Logs: Myrtle Cunningham, WA6ISY, 1105 E. Acacia Ave., El Sugundo, CA 90245.

YU 80 Meter C.W. DX Contest

Starts: 2100 GMT Saturday, January 11
Ends: 2100 GMT Sunday, January 12

The YU DX Club organized this one to stimulate activity on 80 c.w.

Exchange: RST plus QSO number. (001)

Scoring: Contacts between stations in the same country 1 point. With other countries on the same continent 2 points. With countries on other continents 5 points. Contacts with YU stations 10 points.

Multiplier: One for each DXCC country, including own, and each YU prefix worked.

Final Score: Sum of QSO points × sum of DX countries and YU prefixes worked. (Entries may be single or multi-operator.)

Warren Croke, WA4DWR proudly displays the Ted Thorpe, ZL2AWJ Memorial Trophy, won by station W4IZ/KV4 in the 1972 CQ WPX SSB Contest. The award was donated by Don Miller, W9WNV for the world high score in the multi-operator, single transmitter category. Operators on the winning team were K4BBF, W4DQD, W4PJD and WA4DWR.

Awards: Certificates to top scorers in each country, with 2nd and 3rd place awards where justified. (Call areas in W/K, VE, PY, VK, ZL, JA, UA9 & UAØ will be considered as separate areas for awards.) There are also Trophies for continental leaders.

Include a summary sheet and the usual signed declaration. Check log for duplicate QSO's. Taking credit for dupes in excess of 3% of the total made means disqualifiication.

Mailing deadline is March 15th to: YU DX Club SRJ, P.O. Box 48, 11001 Belgrade, Yugoslavia.

DL QRP C.W. Contest

Starts: 1800 GMT Saturday, January 11
Ends: 1500 GMT Sunday, January 12

The DL Activity Group runs two of these QRP Contests each year, July and January.

Power input is limited to 10 watts or less, single operator and c.w. only. QRO stations may participate but only contacts with QRP stations are valid. Limit your operation to 15 hours, the 6 hours rest period may be taken in two parts.

Contacts may be made on 3.5, 7, 14, 21 and 1.8 or 28 mHz, with any station QRP or not.

Exchange: RST plus QSO no. and power input. Add "x" if transmitter is crystal controlled. (ie: 579001/8x) Stations using more than 10 watts use QRO instead of power number.

Scoring: Contacts with stations in same country 1 point, other countries on same continent

2 points, DX on other continents 3 points. If QSO is with another QRP station add 3 more points. (4 to 6 pts) There are also "handicap" QSO points if your power is less than 3 watts or you are xtal control. Additional points if station worked also meets above requirements. (*Much too complicated, suggest you let DJ7ST figure out that part of score. Ed.*)

Multiplier: Each DXCC country, 1 if on own continent, 2 if on other continents. Call areas in JA, PY, VE, VK, W/K, ZS will be considered as separate multipliers.

Final Score: Total QSO points × country multiplier from each band.

Use separate log for each band and a summary sheet showing the scoring, time of rest period equipment description. Plus usual signed declaration.

Mailing deadline is February 15th to: Hartmut Weber, DJ7ST, D-3201 Holle, Kleine Ohe 5, West Germany.

Giant RTTY Flash Contest

1500-2300 GMT Saturday, January 18
0700-1500 GMT Sunday, January 26

This is the 7th RTTY contest sponsored by *CQ Elettronica* magazine of Italy, called Flash because of the short two periods of operation.

All bands may be used, 3.5 thru 28 mHz, in that portion of the bands used by RTTY stations. The same station may be contacted on each band for exchange points and multiplier credit.

Exchange: Call, RST and CPR Zone.

Scoring: Contacts with stations in the same Zone 2 points. With stations outside one's own Zone, according to value in the CPR exchange point table.

Multiplier: Each DXCC country and W/K and VE call areas worked on each band.

Final Score: Total exchange points × total multiplier × number of QSOs. (There is also a handicap of 2% to 8% deducted from the final score based on the position achieved in former contests.)

Awards: Gold medal for 1st place, Silver for 2nd and Bronze for 3rd. The 4th to 6th place winners will receive a years subscription to *CQ Elettronica*, 7th to 10th place a 6 month's subscription.

Points and position achieved in this contest will be included for the World RTTY Championship for 1974.

The contest is also open to s.w.l RTTYers with the same scoring rules.

Logs must be received no later than Feb. 28th and go to: Prof. Franco Fanti, via Dallolio n 19, 40139 Bologna, Italy.

CQ WW DX 160 Contest

Starts: 2200 GMT Friday, January 24
Ends: 1600 GMT Sunday, January 26

Rules same as in previous years. This is a c.w. only contest, no c.w. to phone or cross bands contacts will be allowed.

Exchange: RST plus a three figure QSO number starting with 001, and your state or VE province. It is not necessary for DX to send their QTH, the prefix will identify them.

Scoring: For W/VE/VO, 2 points per QSO with other W/VE/VO stations. All DX contacts are worth 10 QSO points. (DXCC country list)

For all other countries, 2 points per QSO with stations in same country, 5 points with stations in other countries. Except for contacts with W/VE/VO which count 10 points.

Multiplier: For all stations. A multiplier of one (1) for each US state, Canadian province and DX country worked. (KH6 and KL7 are considered DX, the District of Columbia same as Maryland. And remember that VE1 is divided into 3 provinces, New Brunswick, Nova Scotia and Prince Edward Island. VO1 and VO2 are separate.)

Final Score: Total QSO points multiplied by the sum of the multiplier.

Disqualification: Violation of the rules and regulations pertaining to amateur radio in the country of the contestant, or the rules of the contest, or unsportmanship conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. Decision of the Committee is final.

Awards: Certificates to the top scorers in each state, VE province and DX country, additional awards if the score or participation warrants. A Plaque will be awarded by *CQ* to the highest scoring single operator station.

Log sheets and United States Regulations for 160 may be obtained from *CQ* by sending a large s.a.s.e. with sufficient postage.

Mailing deadline for contest logs is February 28th to: *CQ* 160 Contest, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

Editor's Notes

If you have not already sent in your Phone log for the recent *CQ* WW Contest you had better get it in the mail as soon as possible.

A late ARRL Bulletin advises that the 1975 ARRL DX Contest will have several rules modifications. The most important being that single operator stations will now be able to compete in one of three categories. All band, High band (20-15-10) Low band (160-80-40). A very noteworthy improvement, one I am sure will be welcome by the contest fraternity. Now if we can have the contest period cut down to one week-end for each section we would just about make everybody happy.

May the Holiday Season be a very happy one for you and yours and that you will receive many Blessings during the coming year.

73 for now, Frank, W1WY

THE awards PROGRAM

BY ED HOPPER,* W2GT

USA-CA HONOR ROLL

2000		500			
WA1KMP	208	W1UYL	1012	K7AHO	1015
1000		WA5ZKE	1013	W1SBU	1016
W1SBU	337	WA3TLS	1014		

THE "Story of the Month" for December as told by "Kib" is:

James K. Ramsey, WA4ULL

(All Counties #72, 3-2-72)

"Saw daylight September 26, 1913. Have been in textiles most of my life, electronics is my hobby and has been since I was a small boy.

"My amateur ticket was received in 1964 and I was introduced to County Hunting by Roger, WB2WZE. On March 11th, 1969 I was playing around on 20 meters and when I called QRZ, I think about 50 fellows yelled out, "you are on a busy frequency". Roger was mobile at the time and asked what County I was in, and if I would run it on the Net. I put out Aiken County, S.C. and had about 30 contacts, some with those who are 3079ers now. Boy was I scared, but I survived it all. *(Note by Ed: Reminds me of the fist time I checked into the Net—what a mess I made of it—WOW!)*.

"I got so enthused about County Hunting that I bought a mobile rig, and wow, made 'em all by March 1972.

"I would like to thank *all* those who gave me the many Counties and also the NCS stations who were very patient with me. The stations are so numerous, but I would like to mention some, such as WAØWOB, WØSJE, WØYLN, W4YWX, WB4FBS and I can't leave out Danny, K8DCR who gave me my last two in Kentucky to finish them all.

"I guess County Hunting gets in the blood like hunting or fishing, as I can't stay away from the Nets and trying to work them all again!

"And to climax it all, each County Hunter should go to at least one July 4th Convention and meet so many of the fine gals and fellows who comprise the County Hunter Group—boy that's a real treat!

"Oh yes, to cap it all off, I had the pleasure of meeting Roger, WB2WZE at the Fort Wayne Convention in 1973."

*P.O. Box 73, Rochelle Park, N.J. 07662.

Our records show that "Kib" got USA-CA-500 July 25, 1969. Then on August 4, 1971 he received USA-CA-1000 through USA-CA-3000, with the jack pot being hit on March 2, 1972.

Awards Issued

Marge Doucette, WA1KMP (XYL of WA1-KMQ) acquired— USA-CA-2000, endorsed All A-1.

Stan Swenton, W1SBU won USA-CA-500 and USA-CA-1000, both All A-1.

Mixed USA-CA-500 Awards went to:

Jim Carroll, W1UYL.
Don Banta, WA5ZKE.
Lawrence Barbary II, WA3TLS.
Marten Martenson, K7AHO.

Awards

The Lee William Cook, WA8WNK/DL5LC Certificate: Although the foto of this award was on page 63 of August '74 *CQ*, some might have missed the rules which were in the "Story of the Month" and next to the foto on page 63.

Space Net Award: Although the foto of this award did appear on page 64 of August '74 *CQ*, no rules were listed. This Award will be presented to any and all contacts in excess of 200 miles, additionally it will be presented to check-ins on the new Space Net, 50.2 mHz weekly on Friday 8:00 P.M. local time. Write to: Mr. A. W. Slapkowski, Director Space Net, WB2MTU, Box 909, Sicklerville, N.J. 08081.

Worked Central America Certificate: Work all 7 Countries, TG, VP1, YS, YN, TI, HR, and HP (KZ5). Send list and $1.00 to HC1TH/K5ODZ, 4805 Willowbend Blvd., Houston, Texas 77035.

G P CW Award: Sponsored by the Beach Group of CW—Santos—Brazil, the GPCW Award is

[*Continued on page 69*]

Short wave listener county hunters also like special auto license plates, Fred, WDX2OBU, got SWL-73.

SURPLUS sidelights

BY GORDON ELIOT WHITE*

THE Collins AN/ARN-14 navigation receiver has had a long and honorable career in the U.S. Air Force, and is now being retired from service. I have seen quite a few of these units in surplus, and at prices which indicate that they are being sold more to the hobbyists than to, say, foreign air forces.

The AN/ARN-14 was one of the first "omni" navigation receivers, built after World War II to use the VOR system, developed by the Civil Aeronautics Administration late in the War. VOR stands for **V**ery high frequency **O**mni-directional **R**adio range. It replaced the old low frequency Adcock ranges which were dramatized in the old radio shows.

(*Pilot says "we're on the beam!" static crackles, and a faint "dit-dah" is heard.*)

Where the Adcock ranges required the pilot to navigate by listening for a merged tone and gave an "A" or an "N" in Morse for deviating to the left or right, the "omni" range displayed its information on a panel meter, a great advance over listening for the beam tone in a headset. It was v.h.f., which eliminated much interference, and perhaps best, it had 360 "beams" to or from each station, versus the four courses of the Adcock ranges. I well recall being lost near Philadelphia once, on top of a low cloud layer and trying to figure out which of the four range legs I was on. My compass had hung up, and although I flew right over the transmitter, I hadn't the foggiest idea which leg to fly from there.

The basic theory of the omni range is similar to that of a lighthouse, translated into electronics. When the rotating beam passes through North, a second light flashes. By timing the period between the flash and the arrival of the rotating light, a navigator can tell the compass direction to the lighthouse. In the Omni, a directional transmitter rotates a narrow v.h.f. beam at a 30 c.p.s. rate. When it passes through North, a reference signal is transmitted. The receiver computes the phase difference between the two and circuits in the navigation demodulator match the phase shift with a servo-type device which indicates direction when the phase shifts are at zero difference.

A Morse tone superimposed on the signal allows identification of the station by ear, although Omni channels are generally selected by crystal control, rather than by tuneable receivers, and there is little chance for error. Voice signals are also added to the VOR signal, for transmitting weather reports or other airborne communications, so VOR receivers are pretty good general-purpose audio receivers as well as navigation sets.

The AN/ARN-14 consists of an R-540/ARN-14 receiver, ID-249 or ID-250 course indicator, ID-251 control indicator, AT-172 antenna, C-760-B or C-996-A control head, and DY-66B or DY-84 dynamotor.

For amateur use, the receiver and the control head are the only components really required, if an a.c. power supply is to be built. If you have a good stiff 24 v.d.c. power supply, you can use the dynamotor, although the efficiency is so low as to be wasteful of electric power for long-term use, as well as noisy.

The R-540 is a double-conversion superhet covering 108-135.9 mHz. It has 280 channels spaced 100 kHz apart. (This alone makes it obsolete now, with v.h.f. channels spaced 25 kHz apart.)

In aircraft usage, 108.1-111.9 mHz is a "localizer" band, used for airport instrument landings. The 112.0-117.9 mHz band is reserved for the omnirange, 118.0-121.9 mHz is an airport tower band. General en-route airways communications are carried out in the 122.0-135.9 mHz band.

In the late 1950's the military went to a different type of navigation, more useful to tactical combat use, known as TACAN. A portion of the TACAN system, providing a display of distance information not offered in the omni system, has been adapted to civilian aircraft under the designation DME, for **D**istance **M**easuring **E**quipment. TACAN helped obsolete the ARN-14 as more recent gear has offered more performance with less weight.

The antenna input to the R-540 id 52 ohms coax. Audio output is 300 milliwatts into a 500 ohm load.

Sensitivity is better than 3 microvolts for a 6 db signal to noise ratio. Selectivity is only fair by amateur standards; 6 db attenuation outside of a 45 kHz bandwidth. For 160 kHz band, attenuation is 60 db.

Stability is rated at .01% or better, and frequency response, important in the omni navigation system, is within 8 db from 300 c.p.s. to 3500 c.p.s.

The set has automatic volume control, noise limiter, and squelch.

The dynamotor power supply draws 3.25 amps at 26 volts, the dynamotor output is 245 v.d.c. at 240 ma. The 21 tubes and other current drawing components boosts the full power consumption of the set to 5.7 amps at 26 volts, plus another 2.3 amps to operate the channel-switching mechanism.

*1502 Stonewall Rd., Alexandria, Va. 22302.

RECEIVER-TRANSMITTER

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USED, REPAIRABLE **$125.00** USED, CHECKED **$195.00**

T-195/GRC-19 TRANSMITTER: 1 5-20 MHz, 10 Bands. Freq. stability 0.03% plus 1000Hz. Manual or automatic tuning. CW, voice, or FSK operation. Power output: 50 Ohm antenna; 1.5-12 MHz 100 watts, 12-16 MHz 90 watts. 16-20 MHz 80 watts. Input voltage required: 22-30 VDC 42 Amps maximum, standby 9 amps. Size: 11½ x 14¼ x 22". Wt.: 122 lbs.; Shpg. Wt.: 150 lbs. Price: Used - Complete Repairable: **$89.50**

MT-851 MOUNTING BASE for R-392 & T-195. Shpg. Wt.: 60 lbs **$10.00**

CX-1599 CABLE, connects R-392 to T-195 — 10" length: $6.95. BATTERY CABLE for T-195 w/Plug: $4.95. T-195 Maint. MANUAL: **$7.50**., AN/GRC-19 Manual: **$8.50**.

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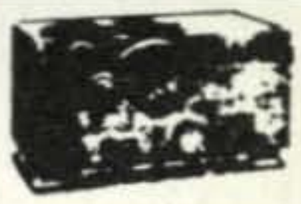

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The first intermediate frequency amplifier is variable from 19.45 mHz to 21.35 mHz, while the second i.f. is a fixed 3.15 mHz.

Obviously the ARN-14 is useful for monitoring aircraft frequencies, even, with a bit of re-tuning, for picking up f.m. broadcasting, but it should lend itself to conversion to 2 meters, although a point-by-point conversion is rather complex, and too lengthy to go into in this column. For someone interested in learning more about aircraft navigation systems, the ARN-14, with its localizer, omni, and phase localizer systems, is a pretty inexpensive training aid.

Although we cannot re-print the diagram here, I have the original, and will make Xerox copies at $1.00 each, postpaid. ■

Awards [*from page 67*]

issued to amateurs of any country who send proof of contacts with 3 different members. Contacts must have been made after November 5, 1973. All authorized amateur bands can be used, but only c.w. (A-1), with a minimum report of 3-3-8. Applications should include log data anthenticated by a recognized Amateur Radio Association/Club and be sent to: Grupo Praiano De CW—GPCW, P.O. Box 1319, Santos, 11.100 S.P., Brazil. To cover postage 5 IRCs should also be enclosed. Members are: PY2BBO; PY2BKT; PY2CE; PY2CJW; PY2-CZL; PY2EQR; PY2FNE; PY2FPE and PY2TT.

Notes

I was just enjoying looking through my foto Albums of my *many* County Hunter *friends*, and wish I could drop each and every one of you a thank-you note, but you know that is impossible. But may I please thank Bertha, WA4-BMC for *all* her kind help and cooperation?

For special MARAC information, QSL data, ICHN data, etc. . . . request same from Bertha Eggert, P.O. Box 6811. South Boro Station, West Palm Beach, Florida 33405 and be sure to include a legal sized self addressed envelope with 30¢ postage on it.

Merry Christmas to you all, hope Santa is good to you all. Write and tell me, How was your month (Year)? 73, Ed., W2GT.

CQ WPX Contest Results [*from page 37*]

UK5ICD	228,256	564	224
UK4HBB	201,587	526	199
UK3AAY	197,800	610	215
UK3WAC	182,208	584	192
UK6AAJ	159,642	467	181
UK2WWW	**154,755**	**533**	**181**
UK1CID	152,609	657	191
UK6LAA	132,060	504	186
UK2WAF	120,624	436	168
UK6LEW	118,736	423	164
UK2PAT	110,408	414	148
UK2GAZ	109,324	447	151
UK2PAO	104,682	404	146
UK5ZAI	97,474	352	163
UK2PAA	26,840	184	88
UK5VAA	13,328	105	68
UK3XAM	5,202	70	51
UK5UAM	2,160	40	27

MULTI-OPERATOR
Multi-Transmitter

CV2T	**2,859,213**	**2803**	**357**
SV1GA/5B4	**2,819,945**	**2381**	**359**
SK5AL	**1,031,916**	**1502**	**339**
JD1YAH	**678,679**	**2708**	**173**
W5NOP/5	**279,720**	**540**	**210**
'A?YEF	**217,434**	**509**	**167**
WB6JOD	**132,080**	**432**	**127**
W9ZTD	**20,145**	**157**	**79**

Our thanks to the following stations who submitted their logs for checking purposes: DK5OS, OH2BOZ, OH5YX, SM1CXE, SP1AGE, SP5JB, SP6DXB, UA1WBG, UA3VAQ, UA3XAW, UA6GL, UB5WAD, UK2WAT, UK3ABX, UK3MAX, UK4FAA, UK4LAC, UK4NAA, UK5IBM, UK5MAZ, UK5MBG, UK5QAV, UK6LAZ, UK6LDN, UT5HP, UT5HT, YO3JU, 9J2EP.

STATION OPERATORS

Multi-Operator Single Transmitter

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Multi-Operator Multi Transmitter

CV2T: CX1BBL, CX3BH, CX4AAC, CX4CR, CX8BBH, CX9BT. **JA2YEF:** Club. **JD1YAH:** JA3GZN, JA7KAC, JA7MQM, JF1SER, JH3TKM, JR1EUX. **SK5AL:** SM5BUT, SMØDSG, SMØEIE, SMØGM. **SV1GA/5B4:** OD5HC, OH2BH, OH2MM, SV1GA. **W5NOP/5:** K5FVA, W5KKZ, W5NOP, W5UDK, W5WQI, WA5AWF. **W9ZTD** & W9VNE. **WB6JOD:** K6PPZ, K6QJZ, K6YP, W6AD, W6KHS, W6SMW, WA6HCL, WA6SUQ, WA6UPE, WB6CNH, WB6RWU, WB6TKE.

This is the operating position at VA6WDX. The Wizard Lake DX Club House is located 40 miles from Edmonton, Alberta, Canada. Due to the 4-ft. deep snow and the closest road being 1½ miles away VE6AN, VE6GS, and VE6LB had to haul their gear in snowmobiles and found it necessary to use snowshoes. The boys feel it was well worth the effort.

1975 SSB Contest. Request your log forms and summary sheets from the *CQ* office. Please send s.a.s.e. or IRC's. The next one coming up is the 29th and 30th of March. Remember it doesn't take a giant score to win a certificate. This is an excellent reason for submitting your logs, regardless of scores.

Hope all you DX stations will tune the US phone parts of the 40 and 80 meter bands, as well as the General portions of all the bands for those extra multipliers and points.

Thanks to all who helped make this 17th annual event a success. It is impossible to acknowledge everyone behind the scene, however, a group that is sometimes taken for granted are the QSL Managers who make DX logs available to us. Thanks for the special assistance provided by Willy, LX1BW; Joe, DL6QX; Bob, W1YRC; Irv, K5YIN; Rubin, WA6AHF; and last but not least, Mr. *CQ* Contest, Frank W1WY.

Hope to work ya in the next one.

73 Bernie, W8IMZ

The 10 meter score of CE6EZ was limited only by the amount of activity on that band, because according to Ralf, the band was wide open. He came in second world high.

Electronic Keyer [*from page 31*]

Switches S_1, S_2, and S_3 may be combined into a three pole four position switch with positions OFF, LOCAL, OPERATE, and TUNE. The LED's can either be mounted in 14-pin DIP sockets, or soldered on a piece of Vector Board. The actual enclosure used in the prototype keyer was a large Minibox that had been used in other projects; the keyer can be packaged in a smaller enclosure.

The LM309K voltage regulator should be bolted to the chassis or a heat sink.

Parts Procurement

This was the first TTL project I had tackled, and I had a bit of trouble finding all the parts at a low cost. Hopefully, the following list of parts and suppliers will be helpful:

Resistors, capacitors, transistors, diodes, phone plugs/jacks:

HAL Communications Corp.
Box 365
Urbana, Illinois 61801

Integrated Circuits, LED's, rectifiers, sockets, LM309K:

Poly Paks
Box 942
South Lynnfield, Mass. 01940

Babylon Electronics
P.O. Box J
Carmichael, Calif. 45608

LM309K, IC's:

International Electronics Unlimited
Box 1708
Monterey, Calif. 93940

Radio Shack (local)

Pots, Vectorboard, misc. parts:

Local or national electronics parts distributors

Dual paddle key for use with keyer:

Brown Bros. Mach. Co.
5370 Southwest Avenue
St. Louis, Mo. 63139

Operation

If a dual paddle is used with the keyer, iambic operation can be obtained. A single paddle key may also be used. The volume and tone controls may be set as desired (these controls may either be on the front panel or on the circuit board). As the keyer warms up, the speed of the clock may vary one w.p.m. or so, but after that the display should not vary except when the speed pot is changed.

I have found that using this keyer is much more satisfying than any other key or keyer I have used before, because I can finally see just exactly how fast I am sending. It should be, even more helpful when preparing to pass a new code exam. ■

Propagation [*from page 63*]

South Pacific & New Zealand	12-14 (1) 14-16 (2) 16-18 (1)	10-12 (1) 12-14 (2) 14-17 (3) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (3) 09-12 (2) 12-15 (1) 15-17 (2) 17-20 (3) 20-21 (2) 21-22 (1) 02-04 (1)	23-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1) 03-07 (1)*
Australasia	14-15 (1) 15-17 (2) 17-18 (1)	09-11 (1) 13-15 (1) 15-17 (3) 17-19 (2) 19-20 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-18 (1) 18-21 (2) 21-22 (1)	02-04 (1) 04-07 (2) 07-09 (1) 03-06 (1)*
Central America & Northern Countries Of South America	08-10 (1) 10-14 (2) 14-16 (1)	07-08 (1) 08-09 (2) 09-13 (3) 13-16 (4) 16-17 (2) 17-18 (1)	06-07 (2) 07-11 (3) 11-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-22 (1) 22-00 (2) 00-06 (1)	18-20 (1) 20-22 (2) 22-03 (3) 03-05 (2) 05-07 (1) 19-21 (1)* 21-01 (2)* 01-04 (1)*
Peru, Bolovia, Paraguay, Brazil, Chile, Argentina, Uruguay	09-11 (1) 11-15 (2) 15-17 (1)	07-08 (1) 08-13 (2) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	05-06 (1) 06-08 (2) 08-10 (1) 12-14 (1) 14-15 (2) 15-17 (3) 17-19 (4) 19-20 (2) 20-22 (1) 22-00 (2) 00-03 (1)	19-21 (1) 21-02 (2) 02-05 (1) 21-04 (1)*
McMurdo Sound, Antarctica	*Nil*	16-18 (1)	06-07 (1) 07-08 (2) 09-11 (1) 17-18 (1) 18-22 (2) 22-00 (1) 00-02 (2) 02-03 (1)	22-05 (1)

Time Zone PST (24-Hour Time)

WESTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	08-09 (1)	07-08 (1) 08-10 (2) 10-11 (1)	06-07 (1) 07-09 (2) 09-10 (1) 10-12 (2) 12-14 (1) 23-01 (1)	18-20 (1) 20-23 (2) 23-01 (1) 19-23 (1)*
Central & Northern Europe & European USSR	*Nil*	07-09 (1)	06-07 (1) 07-10 (2) 10-13 (1) 23-01 (1)	17-00 (1) 19-23 (1)*
Eastern Mediter-ranean & Middle East	*Nil*	07-10 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-12 (2) 12-13 (1) 21-23 (1)	06-08 (1) 18-21 (1)
West Africa	09-12 (1)	08-09 (1) 09-10 (2) 10-12 (3) 12-13 (2) 13-14 (1)	07-10 (1) 10-13 (2) 13-16 (3) 16-18 (2) 18-19 (1)	18-22 (1) 20-22 (1)*
East & Central Africa	*Nil*	09-11 (1)	08-10 (1) 13-16 (1) 21-23 (1)	06-08 (1) 18-20 (1)
South Africa	08-11 (1)	08-10 (1) 10-13 (2) 13-14 (1)	07-11 (1) 11-13 (2) 13-16 (3) 16-18 (2) 18-19 (1) 23-01 (1)	18-20 (1)

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Central & South Asia	*Nil*	17-19 (1)	08-10 (1) 17-19 (1) 19-20 (2) 20-21 (1)	05-07 (1) 18-20 (1)
Southeast Asia	15-17 (1)	15-16 (1) 16-17 (2) 17-18 (1)	07-09 (1) 09-11 (2) 11-16 (1) 16-19 (2) 19-20 (1)	03-08 (1)
Far East	15-17 (1)	14-15 (1) 15-16 (2) 16-17 (3) 17-18 (2) 18-19 (1)	08-10 (1) 13-14 (2) 14-15 (2) 15-18 (3) 18-19 (2) 19-20 (1)	00-01 (1) 01-03 (2) 03-06 (3) 06-08 (2) 08-10 (1) 02-08 (1)*
South Pacific & New Zealand	12-14 (1) 14-16 (2) 16-17 (1)	10-12 (1) 12-14 (2) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	07-08 (1) 08-10 (2) 10-15 (1) 15-16 (2) 16-18 (4) 18-19 (3) 19-20 (2) 20-22 (1) 03-05 (1)	22-00 (1) 00-03 (2) 03-06 (3) 06-07 (2) 07-08 (1) 00-03 (1)* 03-06 (2)* 06-07 (1)*
Australasia	14-17 (1)	08-12 (1) 12-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	07-08 (1) 08-10 (3) 10-12 (2) 12-17 (1) 17-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	01-03 (1) 03-06 (2) 06-08 (1) 01-03 (1)* 03-06 (2)* 06-07 (1)*
Central America & Northern Countries of South America	09-11 (1) 11-14 (2) 14-16 (1)	07-08 (1) 08-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-07 (2) 07-09 (3) 09-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-20 (2) 20-22 (1) 22-00 (2) 00-06 (1)	18-20 (1) 20-22 (2) 22-02 (3) 02-04 (2) 04-05 (1) 19-21 (1)* 21-01 (2)* 01-04 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	10-12 (1) 12-14 (2) 14-15 (1)	08-10 (1) 10-12 (2) 12-13 (3) 13-15 (4) 15-16 (2) 16-17 (1)	08-14 (1) 14-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-22 (1) 22-00 (2) 00-06 (1) 06-08 (2)	20-22 (1) 22-01 (2) 01-04 (1) 22-02 (1)*
McMurdo Sound, Antarctica	*Nil*	12-15 (1) 15-16 (2) 16-18 (1)	16-18 (1) 18-19 (2) 19-22 (3) 22-01 (2) 01-03 (1) 07-09 (1)	23-05 (1)

Math's Notes [*from page 45*]

calibration oscillator to WWV. As the beat note decreases in frequency the speed at which the two LED's switch on during positive and negative half cycles of the beat frequency gets slower and slower until one can easily see the individual LED's go on and off. When both LEDs stay off, the receiver is at zero beat! This same application could also be used as a visual c.w. indicator for those so inclined.

In conclusion, the LED is an extremely unique and useful device, quite easy to work with and may solve some of those "unsolvable problems" we all seem to have from time to time.

At this time I would like to wish all of my readers a very happy, healthy, and prosperous New Year and of course a very Merry Christmas.

73, Irv, WA2NDM

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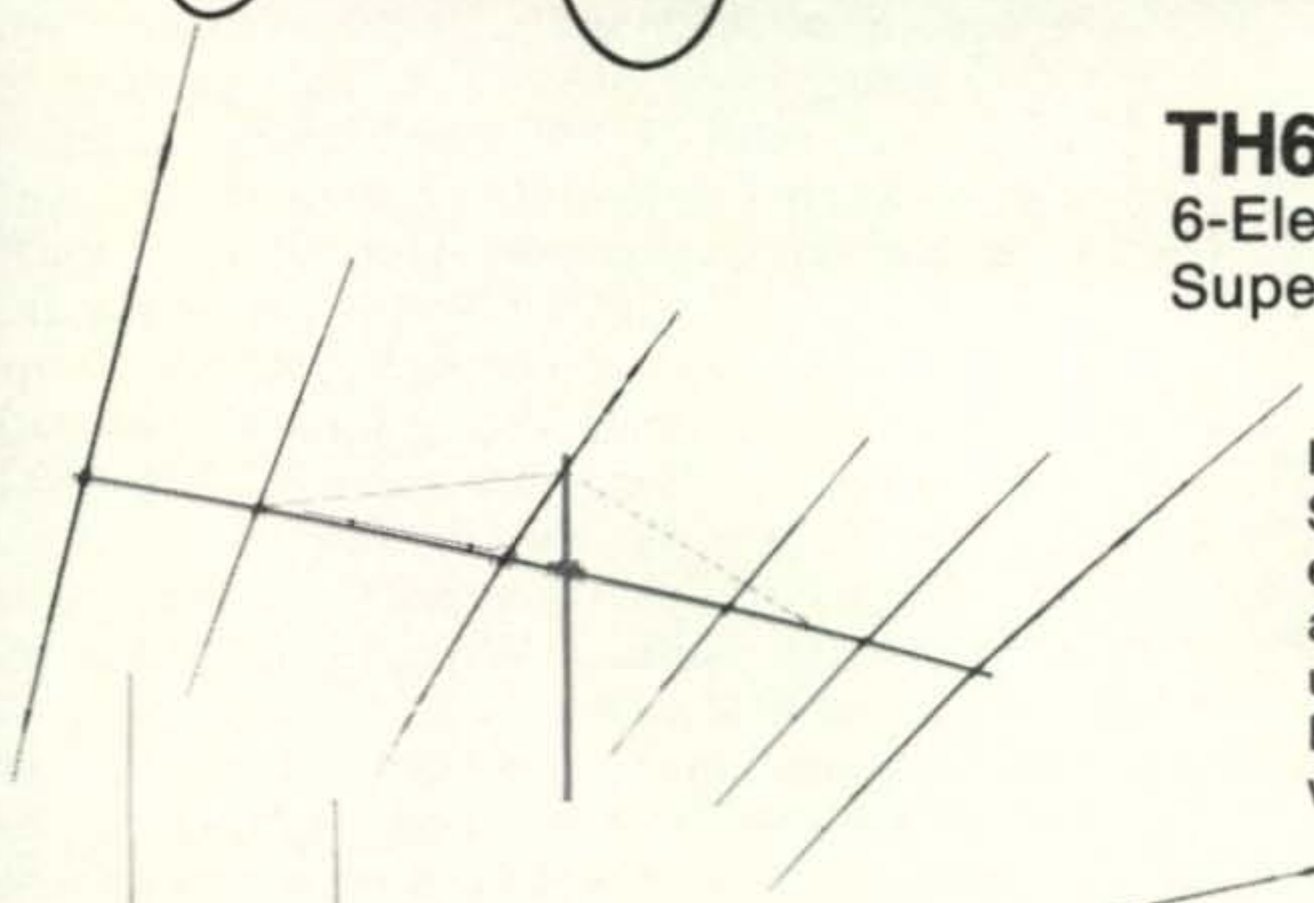

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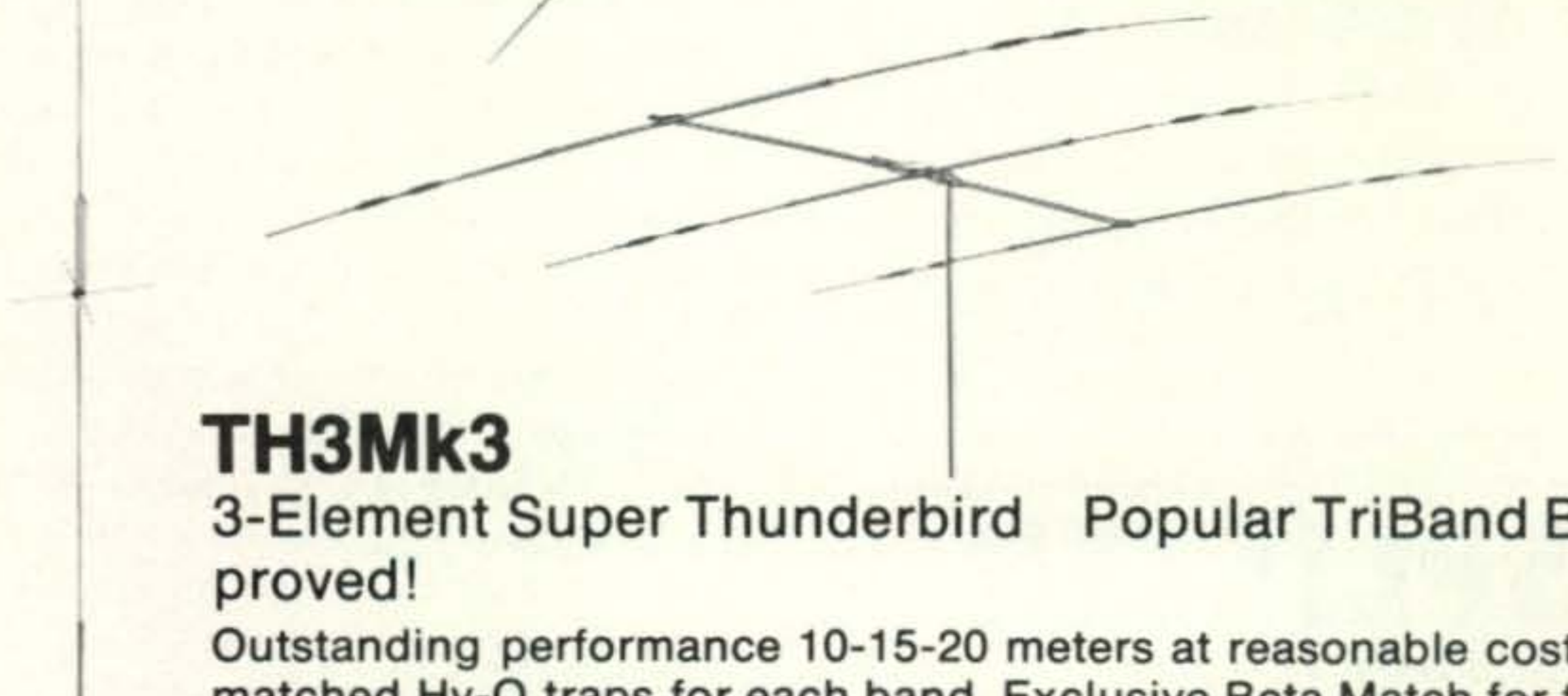

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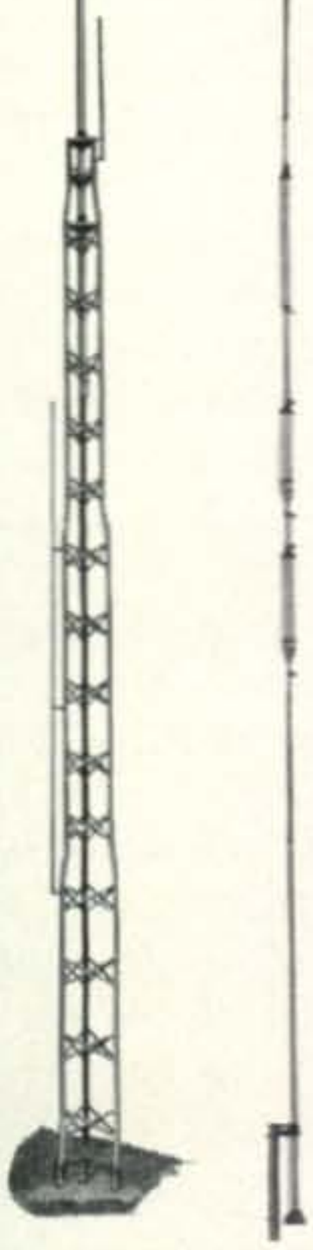

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Novice Shack [*from page 44*]

DXing for Novices because KZ5VV took a real amateur interest in beginners." Thanks also to KZ5EJ, IT, and OD for administering the tests and helping in other ways . . . **Preston Shute, WN4JTP,** 232 Pinewood Dr., Holiday, Fla. 33589 reports, "The first or second night I got on the air, a "VE" and a "TVV" answered my CQ's. Being very green and not wanting to break any rules, I did not answer. Later, I learned where VE land (Canada) is located, and I am still kicking myself. How about TVV?" Preston uses a Heathkit HW-16 transceiver and HG-10B v.f.o. and a 40-meter inverted-V antenna . . . Another WN, **Frank C. Goodell, WN4GFG,** 9405 Westmoreland Ave., Manassas, Va., 22110, was the first to tell us about inverting the equation for capacitive reactance in the September column. We corrected the error in the November copy.

You never know who you will raise when you get on the air. **Ken Anderson,** sporting the brand new call of **WN5LIT,** was in contact with WN5LQI. Unknown to Ken, a small green grass snake had worked its way up the table leg and along side of Ken's arm. Ken's wife walked into the radio shack, saw the snake and screamed. Then, Ken saw the visitor and his code speed went immediately to 30 w.p.m. At least, that is what **Hugh, WB5GLZ**—an honest Texan—reports . . . **Gary L. Feldman, WN2UGO,** 28 Pine Tree Dr., Poughkeepsie, N.Y. 12603, represents the majority view in our informal poll by voting for more items about what makes "Hamming" so much fun and less fundamental theory in the NOVICE SHACK. He says that there are lots of books on theory but only one NOVICE SHACK. He cites examples, which I hope happened to him: the thrill of working a rare DX station that you had worked previously and having the operator call you by name; working an amateur stationed on a Navy base in Maine and working the same amateur a few months later on board a ship on a training mission off Puerto Rico; or going camping and setting up your station, powered by a 12-volt battery, and feeding a make-shift antenna in a rain storm and working a rare DX station in a "pile up." In six months, Gary has worked 45 states and 30 countries using an FT-101B transceiver. For antennas, he uses a CB vertical, 5/8-wave ground plane on 15 meters and a Murch dipole on 40 and 80 meters. And when conditions get better, look out!

As we come to the bottom of the page again, we remind you that the NOVICE SHACK is your column. Send your "News and Views," comments and suggestions to the address on the first page. And you are invited to submit a sharp photograph in our monthly Novice Shack Photo Contest. 73, Herb, W9EGQ

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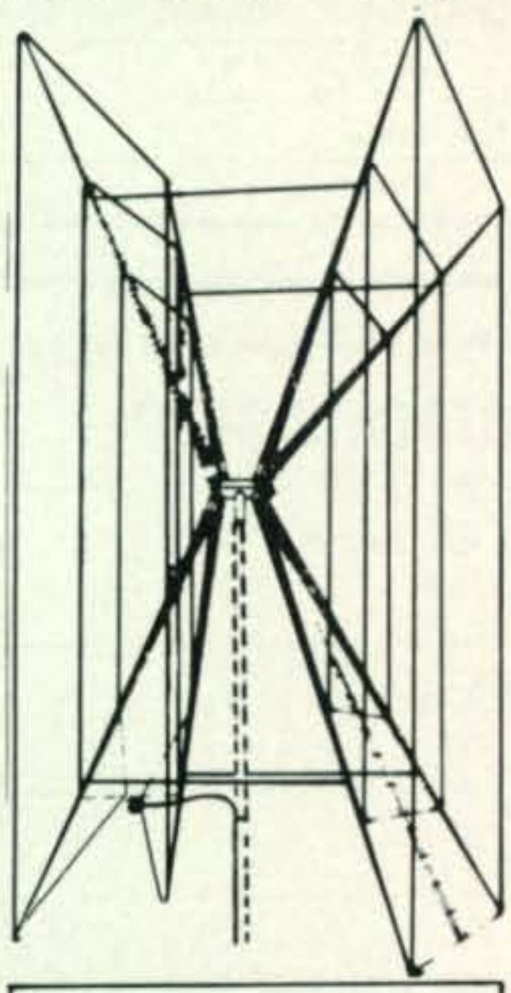

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WANTED: Any equipment, books, or manual on Cryptography. L. Kruh, WN2TSD, 17 Alfred Rd., W. Merrick, NY 11566. (516)378-0263.

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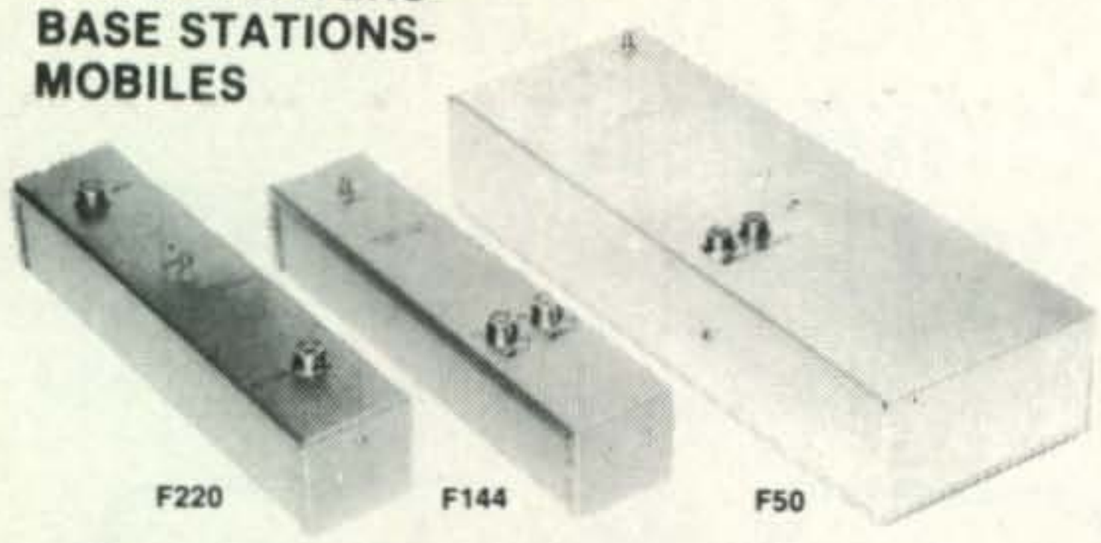

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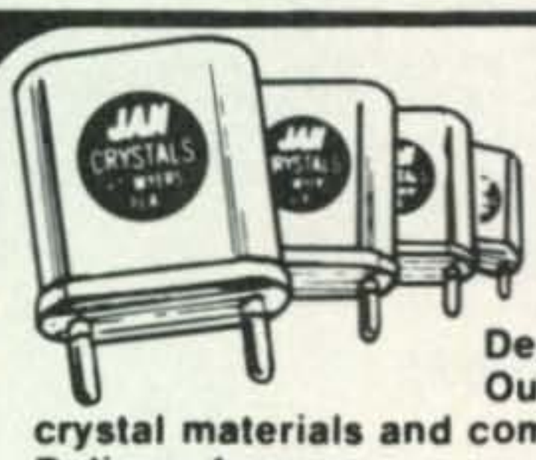

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WANTED: Tunaverter Converter, Model SWL, 9.5-16 MC. Fred Haines, 132 Rural Ave., Lewisburg, PA 17837.

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- Insist on the brand name known for quality *AND* which has the best reputation for outstanding customer service.
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- Insure natural voice characteristics with an audio response *AND* bandpass that is essentially flat from 300 to 3000 Hertz.
- Look for a final amplifier using 8950 tubes designed to handle RF power.
- Determine the "Cost-Per-Watt". Divide the total cost of the system by the P.E.P. Input Wattage to find your best buy.
- Use your Swan Revolving Credit for easy to handle deferred payments.

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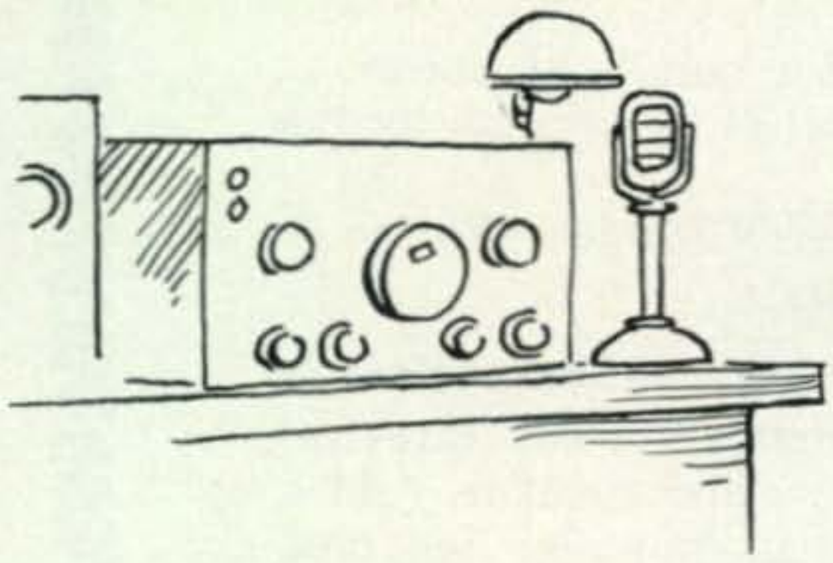

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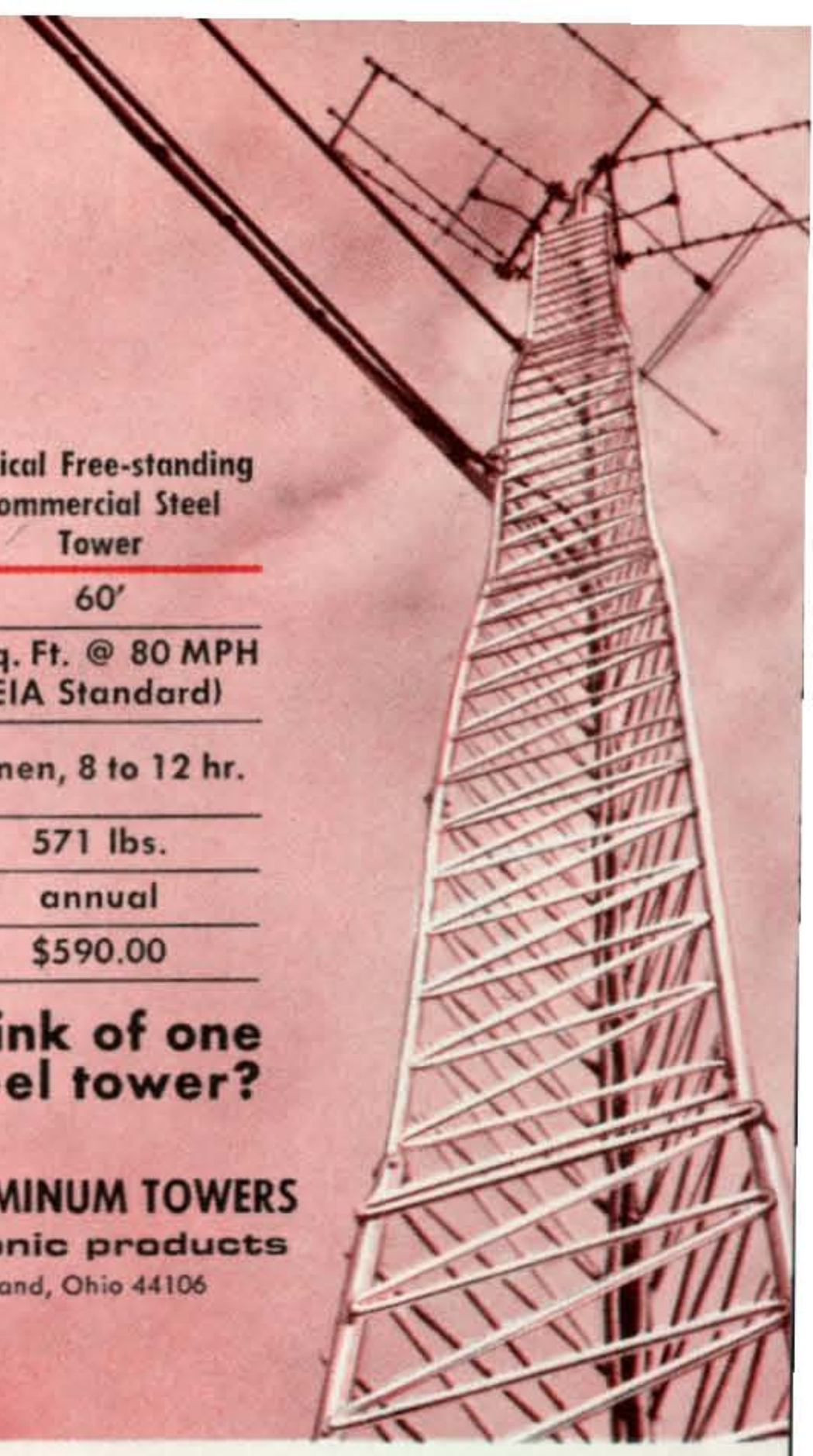

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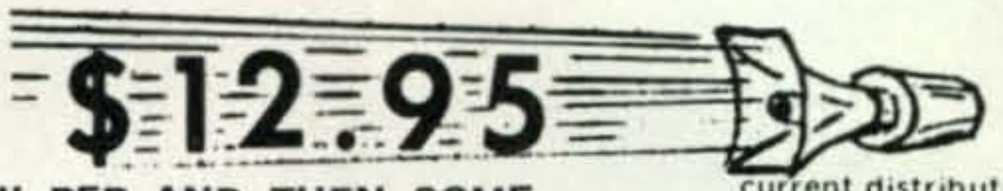

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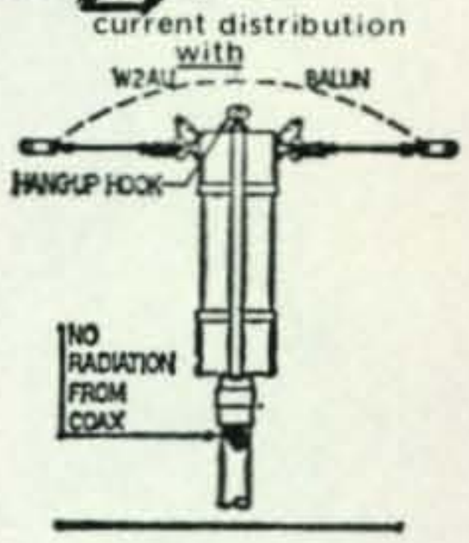

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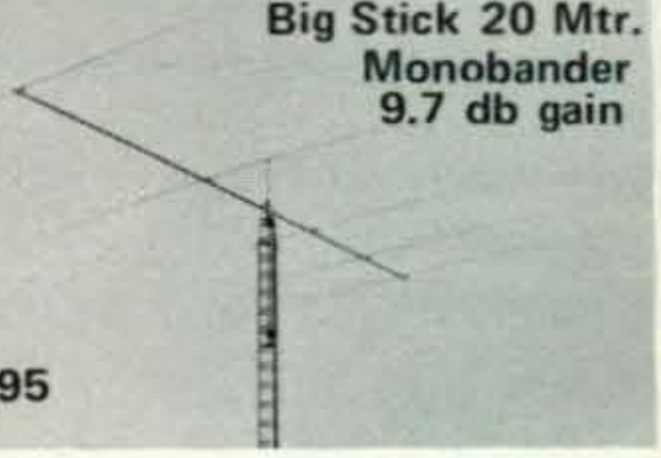

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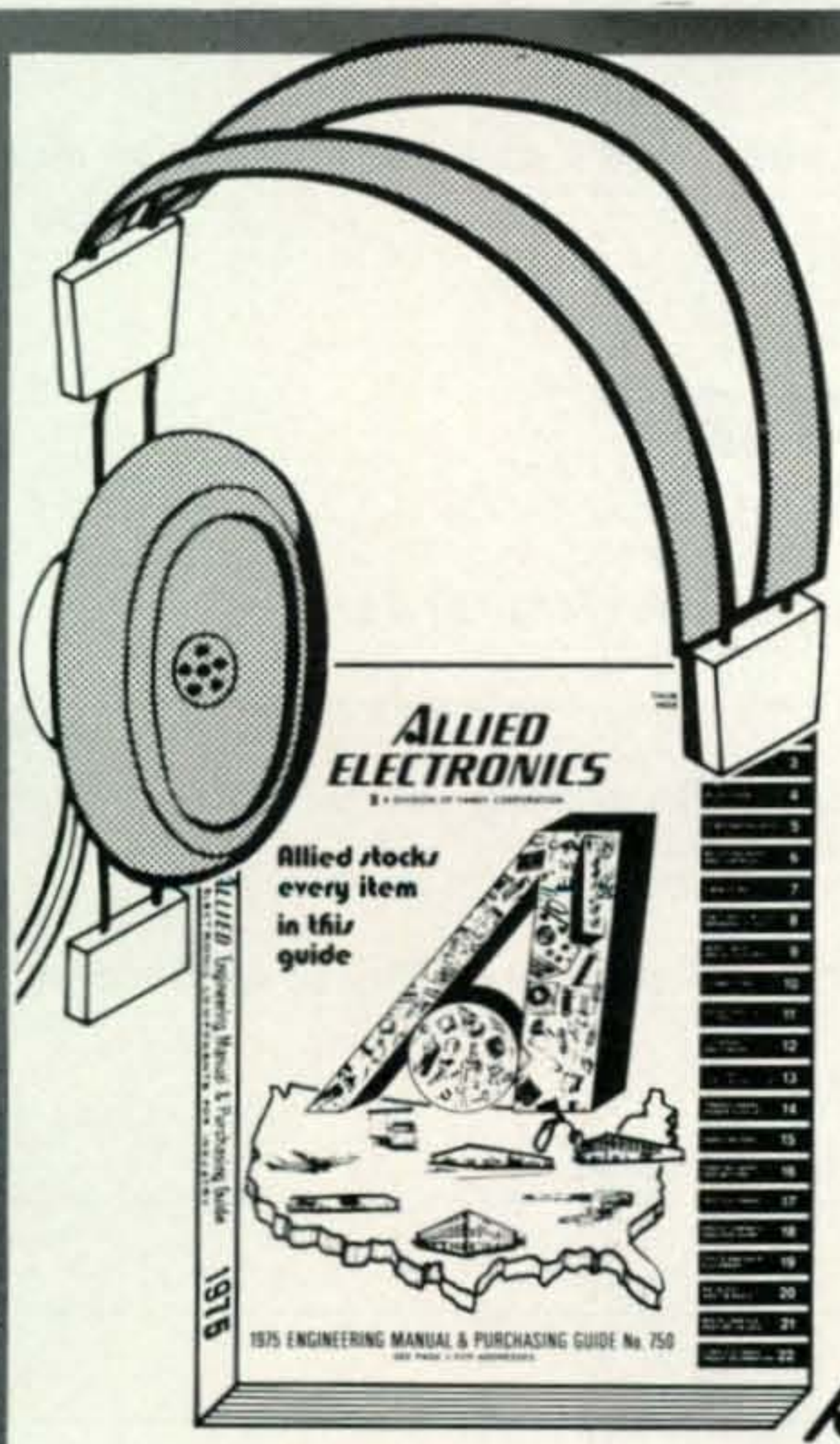

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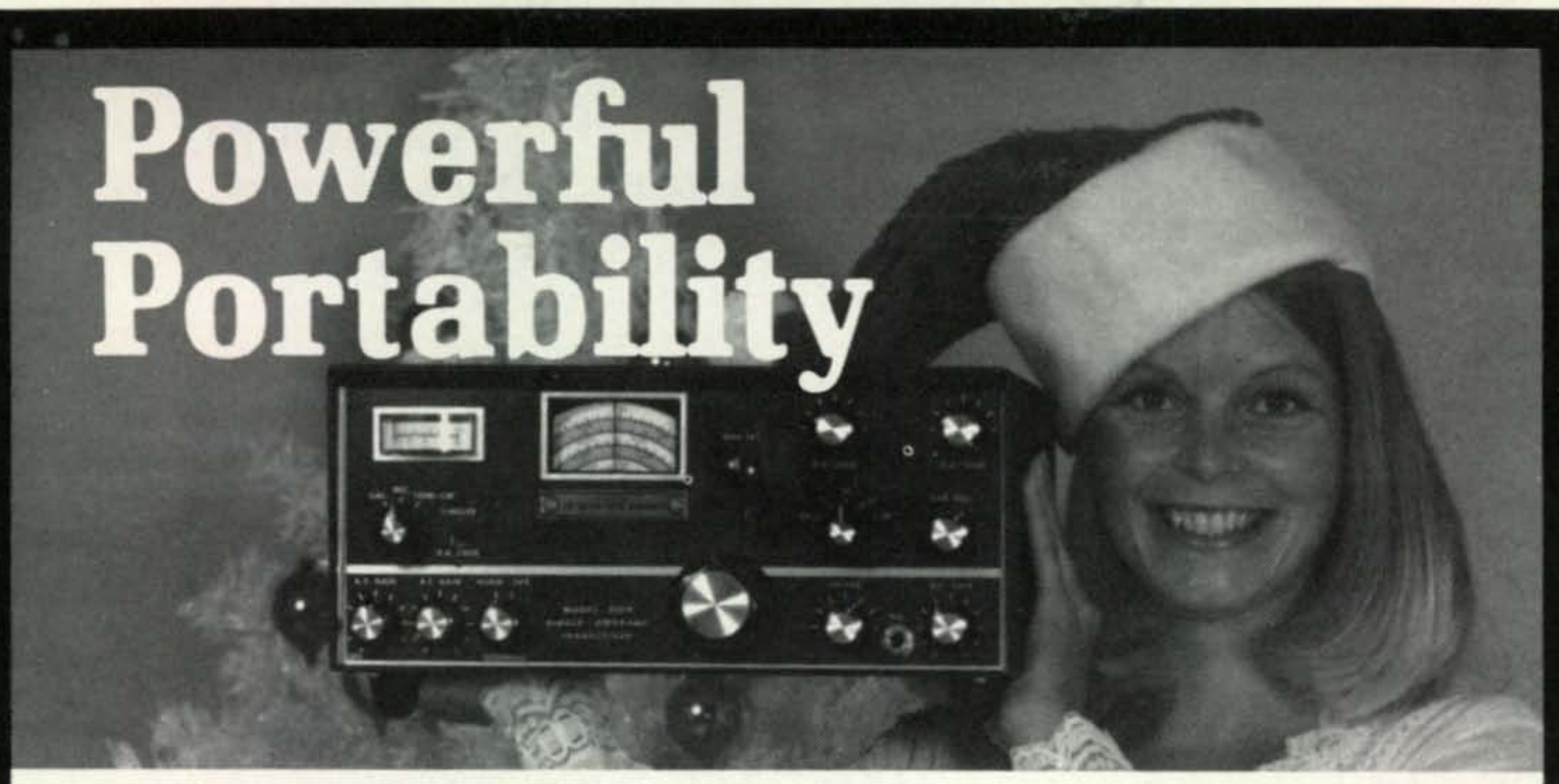

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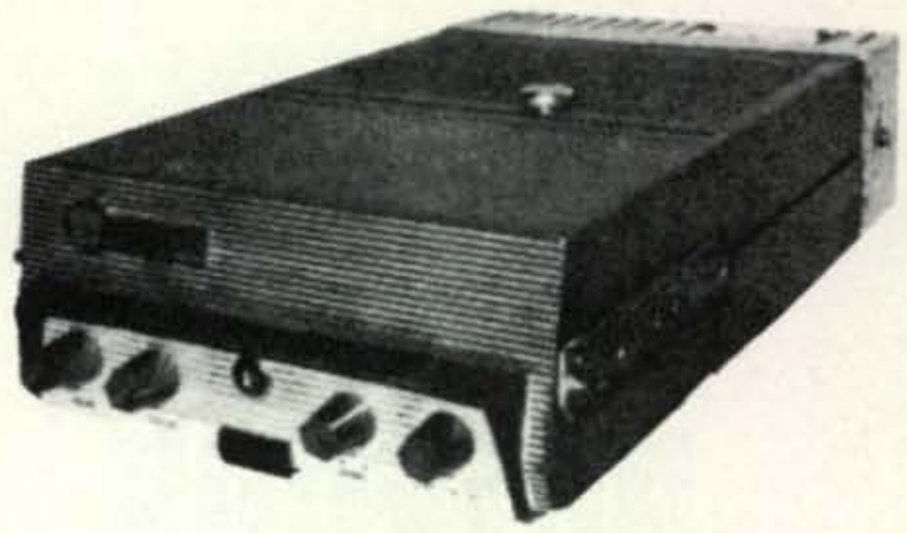

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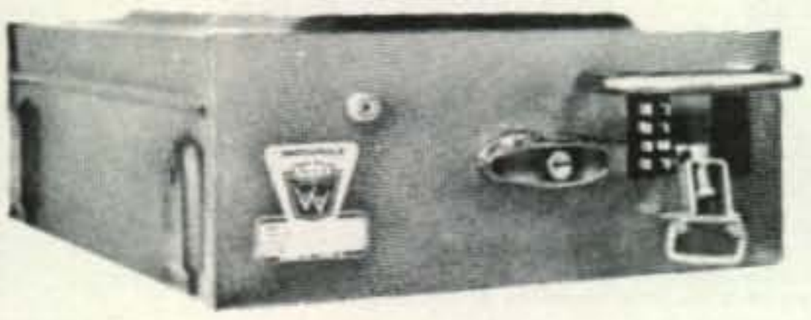

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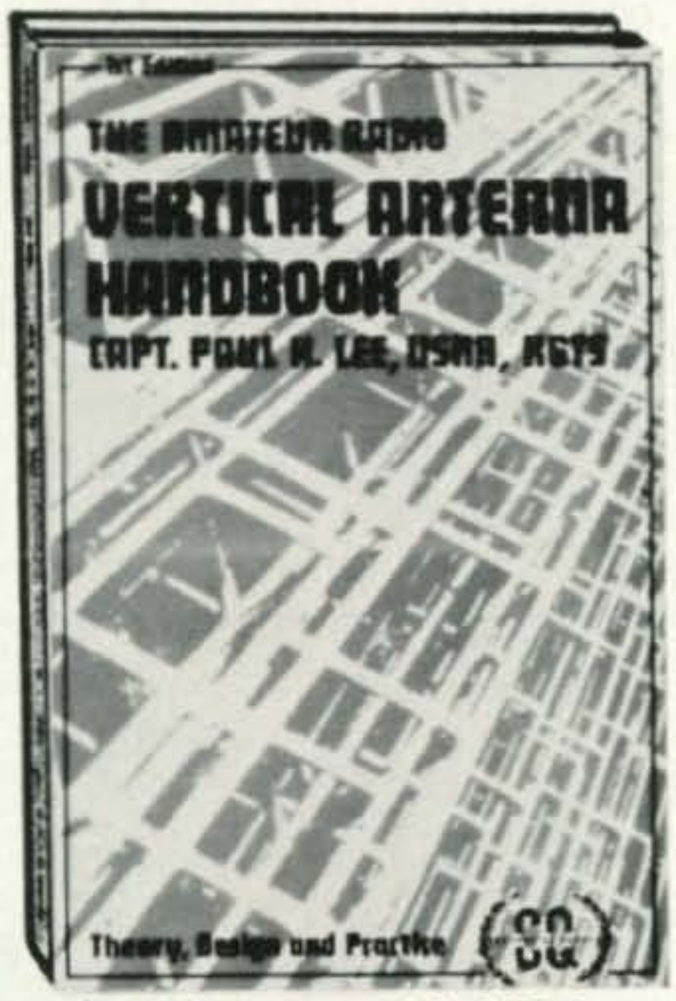

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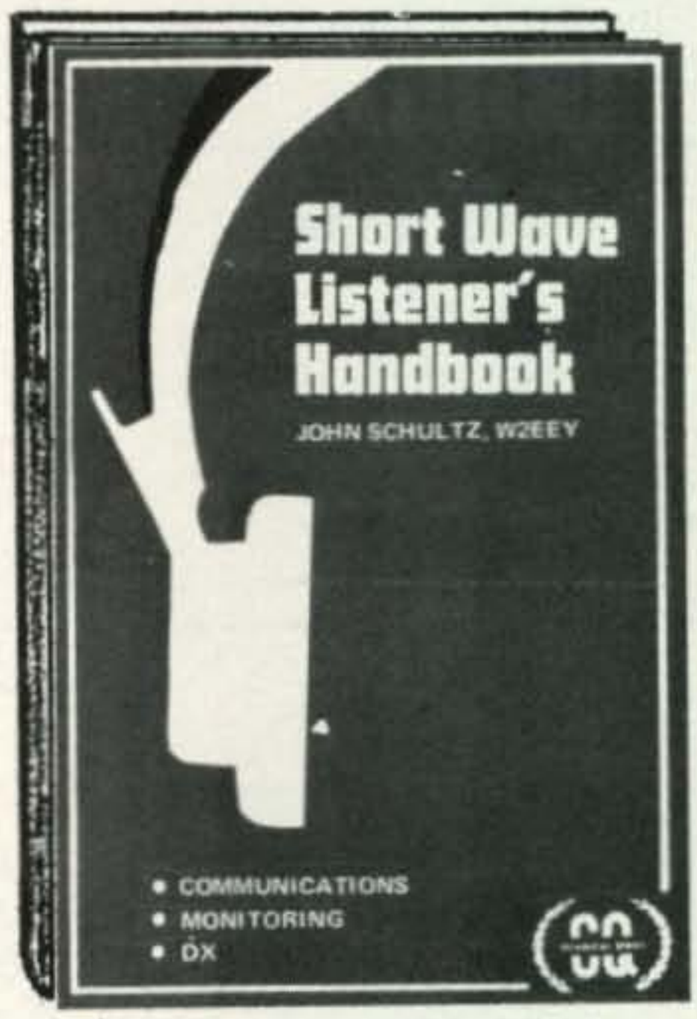

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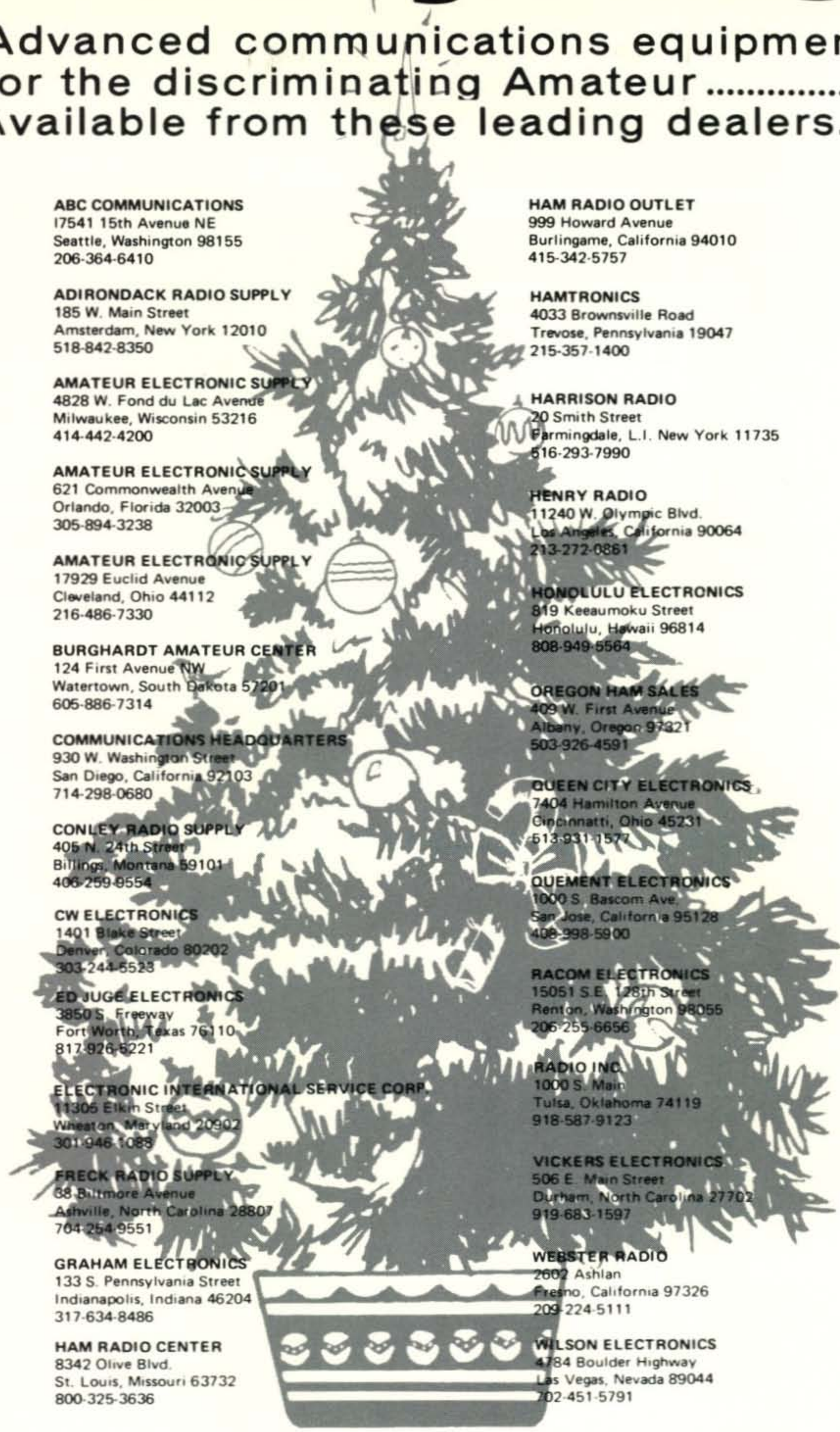

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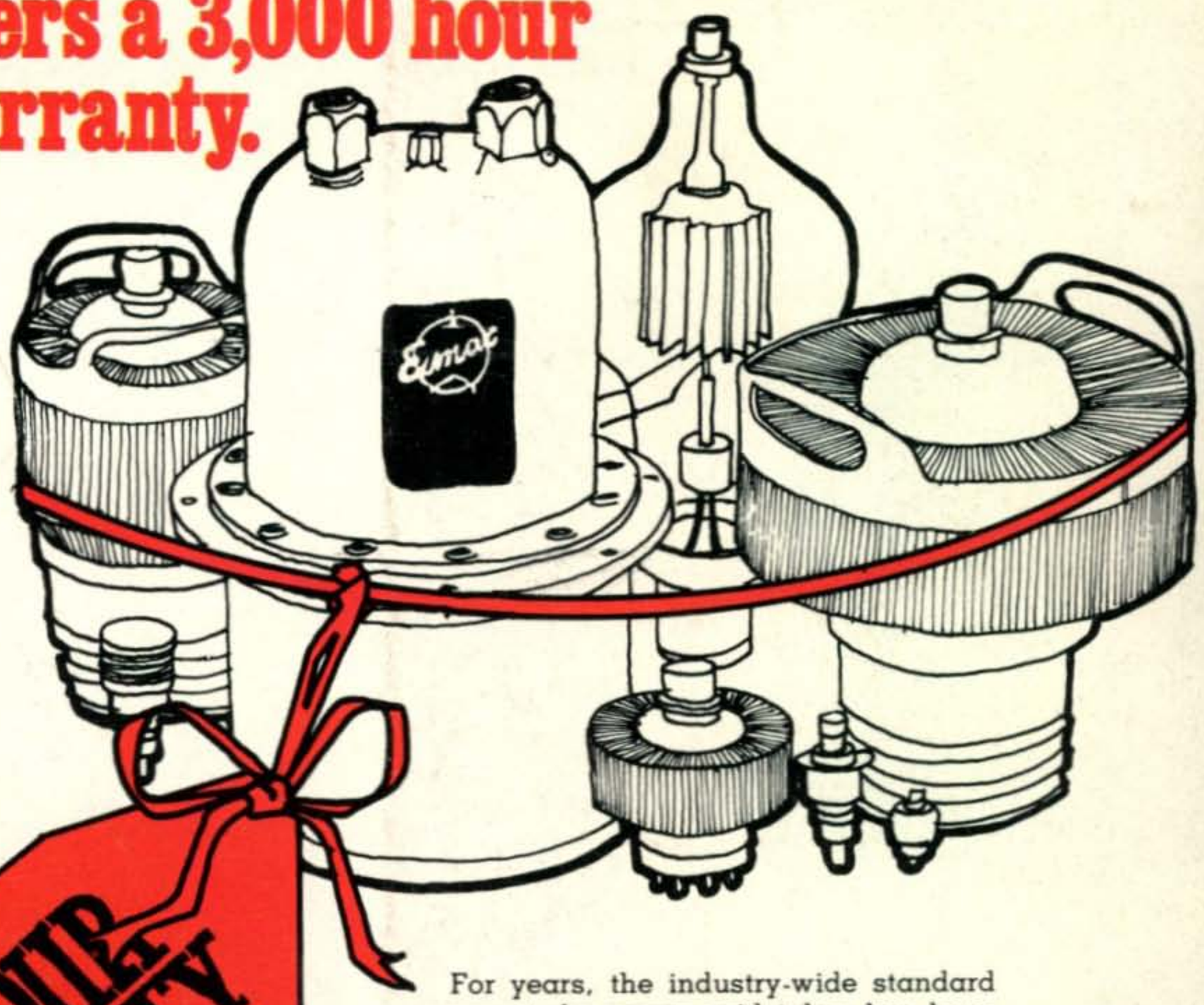

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